The independent MONTHLY magazine for T/S1000,ZX81 users

# timex sinclair user

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6 keyboards compared

How to prevent overheating

## T/S Goes To Camp

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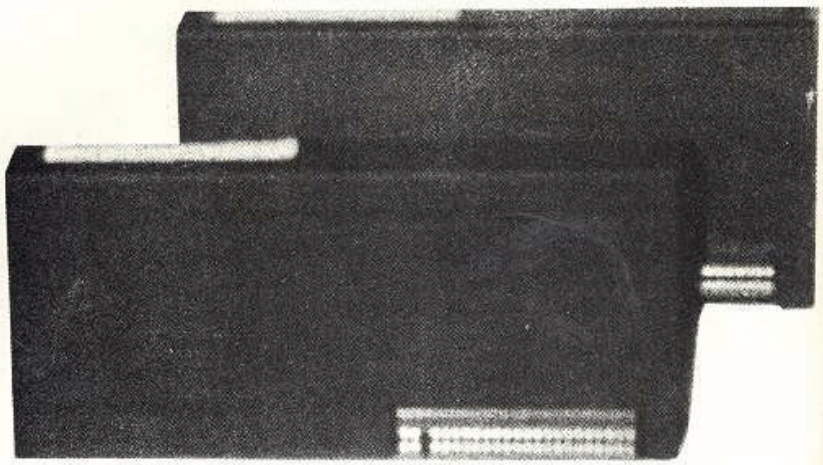

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**Buffalo, N.Y. 14214**

Programs should be on cassette and articles should be typed and double spaced. If you wish your material returned, enclose a stamped, self-addressed envelope.

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## Next month

- How one T/S user created a $2,500 system
- You are your computer's worst enemy! Find out why

**and much more!**

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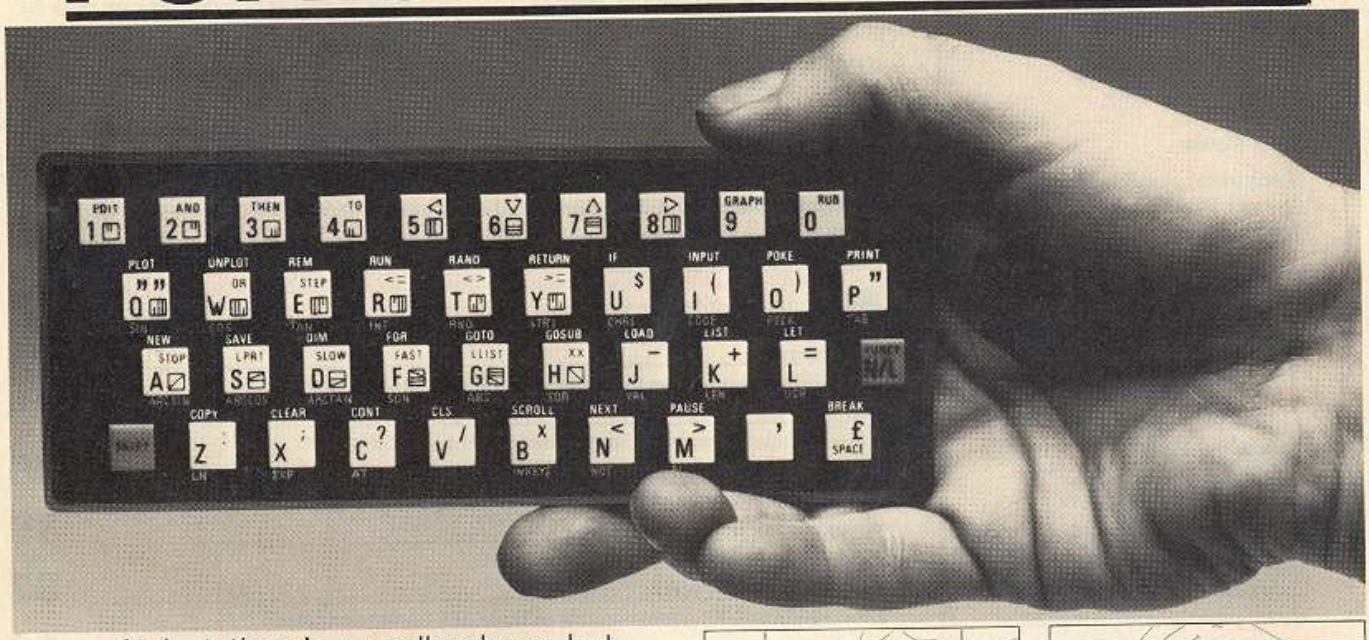

At last there's a really cheap but efficient way of ironing out the TS1000/ZX81's only real bug: its keyboard. The Filesixty Buttonset offers

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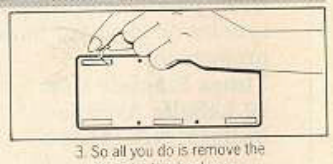
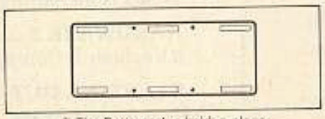
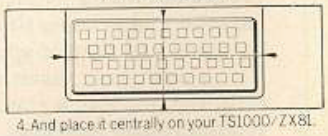


3. So all you do is remove the protective backing.



2. The Buttonset is held in place by self adhesive pads.



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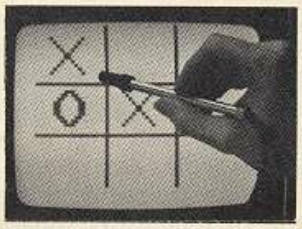

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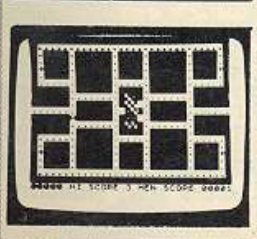

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## Some manufacturers stake claims in the T/S gold rush too quickly

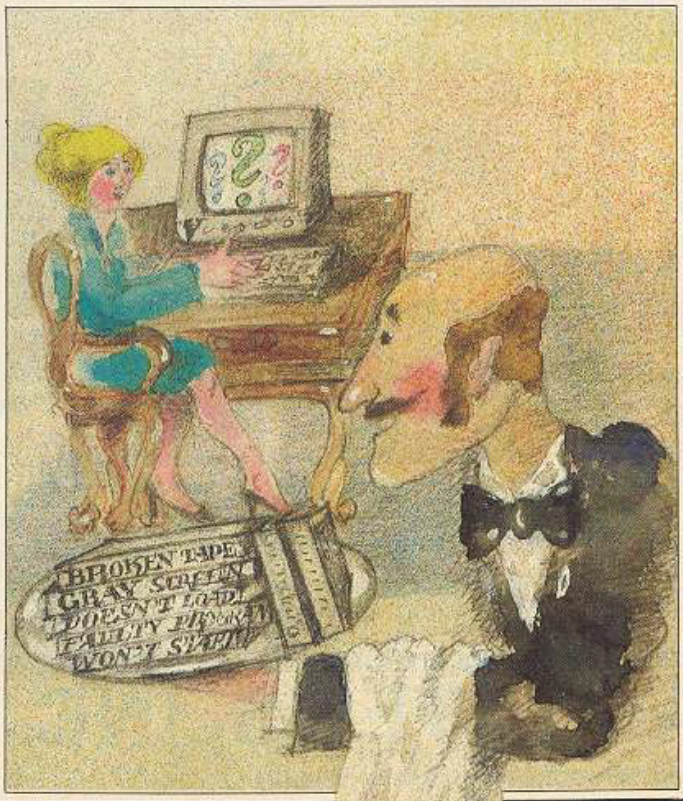
# Software Blues

THE PROGRAM LOADS. Ø/Ø appears on the screen. The printed instructions tell us to type GO TO 1 to start: not the most elegant beginning, but acceptable. Then we are asked LEVEL? but nowhere told how to enter it. Finally logic impels us to press 1, and the screen turns gray and stays that way, as though we have somehow offended the computer and it is pouting. We press BREAK but the gray persists. So, exasperated, we pull the plug on this virgin piece of software and put it with the other Defectives, Unloadables and otherwise Unusables.

There are many programs on the market today for the T/S1000,ZX81. Most perform reasonably well, and a few, superbly. But some companies stake claims in the T/S gold rush too quickly, and their products don't load, or don't deliver what they promise, or come with unclear instructions or none at all.

Thanks to companies like Sinclair and Timex, it is now possible for us to relate to computers as we do to televisions and cars and telephones and microwaves and washing machines — with no deep technical knowledge. Manufacturers should realize that their software may be used by people who think a microchip is a very fast food — and who have no wish to lose their blissful ignorance. We use a radio but wouldn't know a transistor if it bit us. Our radio doesn't demand that we know every wire, circuit and resistor of its internal anatomy. We appreciate our T/S1000,ZX81 for a similar reason.

In the jargon of the trade, this is called "user-friendly." Like a good butler, a user-friendly product provides its services as simply and directly as possible, and never gets in the way. But when tapes jam in our trustworthy tape recorders, or come with inadequate instructions, or refuse to load, they do not give two hoots about users. They get in the way of themselves. The medium obliterates the message.




We think it's time some manufacturers learn what friendship is all about.

Do you agree? What kind of experiences have you had with software? Let us know and we'll publish a selection of your letters. Write to Timex Sinclair User, "Software Experiences," 49 La Salle Avenue, Buffalo, N.Y. 14214. Please include your full name and address when writing.

MUCH good software exists too, of course, as our *Software* pages demonstrate (8 & 9). In evaluating products we have switched to a four-star rating system in which ★ is poor, ★★ is fair, ★★★ is good and ★★★★ is excellent. ★★★★★ means we've found a product that soars above mere excellence, and we'll alert you when that happens. One item in this issue comes close — one of the *6 Keyboards Compared* starting on page 66: can you guess which?

In this issue also we rate the recent Timex Sinclair 2040 printer (page 30) and preview the eagerly-awaited T/S2000 color computer by presenting its prototype, the amazing Spectrum from Sinclair in Britain. Our cover story, *T/S Goes To Camp* (page 12), chronicles what may be the start of a trend — camps that feature T/S computers exclusively: there may be computers more powerful, but none more affordable.

Will the computer soon be as common as television? Tell us what you think on this or any topic. Our *Letters* and *Bulletin Board* sections put your message before a community of more than 600,000 T/S users plus family members and friends who may soon be T/S users too. *Timex Sinclair User* invites you to reach them on these pages. Ø/Ø

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# Letters

## ON U.K. IMPORTS

I need some assistance! It concerns all these helpful books written by the English for the English, then sold to unsuspecting Americans — like me. It seems no one has bothered to edit these programs to be useful to Americans. I hope your experts will warn us of software which is useful only to the English.

**Bert Passanante**
Wilmington, Delaware.

*We agree, Bert, some English publishers have not been fair to us over here. That's one of the key reasons we decided to publish* Timex Sinclair User. *And yes, whenever we review a product we certainly warn users if it is U.K. specific. Many publishers have taken time to edit their products for our market and we will point these out too! Until we've looked at more software and books all we can suggest is read our reviews. Also, let us know of any really bad examples of this problem so we can inform our readers.*

## OVERWORKED

I purchased my ZX81 in the late fall of 1981 and received it just before the end of the year. The 16K came a little later, and I used it too much because the keyboard went out at the end of the first year. The ENTER-FUNCTION key gradually failed so that first the FUNCTION failed, then LET, and finally ENTER.

All is not lost, however, as I have just ordered a T/S1000 for delivery next week to solve the immediate problem.

I am almost 78 years old and have no interest in games and such, but I am interested in engineering and mathematics to the extent that I spend a lot of time converting programs for use on my TRS-80 Model I and the ZX81.

**Thomas A. Rogers**
Morro Bay, California

*Thomas, your persistence is to be admired. We, like you, believe in the T/S1000,ZX81. We hope your new machine stands up to your input!*

*We're glad to hear you want more articles about math and engineering — we're planning to put them in as often as we can.*

## READER SERVICE

How can I obtain copies or subscriptions to *Electronics & Computing*? Their ad which I recently saw gave no address.

**Joe K. Bair**
Oak Ridge, Tennessee

*True, they did not give an address, but we did give them a Reader Service Card Number. At the front and back of your magazine you will see cards labelled "Reader Service Card". By circling 21, printing your name and address on it and mailing it to us, we will send you the information you want. We did it for you this time. Let us know if the system works.*

## SUPPORT FROM S.C.

I was pleased to hear about your publication. I have subscribed to *Sinclair User* but found it difficult to use because it is written for the United Kingdom. I am looking forward to receiving your publication.

**Sandra H. Bonner**
Spartanburg, S.C.

*Well, thank you, Sandra! We agree that North American T/S1000,ZX81 users deserve a magazine of their own. There sure are enough of us. We hope we live up to the high standards of our U.K. cousin,* Sinclair User. *Let us know if there is any special type of articles you would like to see. Till then, happy programming!*

## RAMIFICATIONS

Can the Timex Sinclair 16K RAM be used directly with the Sinclair ZX81? I need to know because the T/S 16K RAM is available in my local store.

**Joseph J. Wiedmann**
Springfield, Virginia

*Yes! The T/S 16K RAM is completely compatible with the ZX81. For more information take a look at our review of some RAM packs in the June issue* (In Search of a Golden Memory, page 12). *Let us know what new and wonderful things you do with your 16K RAM.*

## ON THE 2040

I am a subscriber to your magazine. Will using the silverized electrosensitive paper in my Timex 2040 printer harm the unit? Should I wait until the plain type of Timex paper is available?

**Ernest H. Weaver**
Ashland, Maine

*Glad you're a subscriber, Ernest! About your paper problem — yes the electrosensitive paper will harm your unit. The Timex Sinclair 2040 printer is designed to accept special paper. See our review of the T/S2040 in this issue.*

cont'd on p. 56

## *Write to us*

*Timex Sinclair User* welcomes reader's comments, compliments, queries and complaints. Letters should be addressed to: The Editor, Timex Sinclair User, 49 La Salle Avenue, Buffalo, N.Y. 14214. Please include your full name and address when writing.

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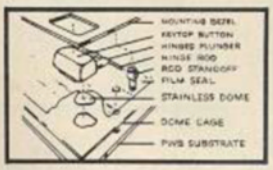


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# Software

Attention manufacturers: Got a software item you'd like us to review? Send it to Timex Sinclair User, Software, 49 La Salle Avenue, Buffalo, N.Y. 14214

**OUR RATING SYSTEM**

★ poor
★★ fair
★★★ good
★★★★ excellent

Occasionally our reviewers will award half-stars for ratings between categories.

## Aliens earn top marks

**3D-ORBITER**

*Melbourne House, 16K*

This space invaders game has superb visual effects that possess almost a three-dimensional quality. To defend yourself (and Earth) you must guard an area two screen-widths across using sophisticated tracking devices including forward radar, a proximity meter and an altimeter. The alien ships grow and display increasingly fine detail as they approach, and explode with wonderful realism. But even after being hit they can dispatch plasma bombs with deadly accuracy, so be careful. *3D-Orbiter* is difficult and requires a cool head and good coordination, but it is very exciting and will provide hours of fun.

★★★★

*For more information, circle 6 on reader service card.*

## Eat the dots ...

**GULP**

*Mindware, 16K*

In this maze game you move around any one of six mazes at any one of nine speeds while a hunter tries to capture you. Though the mazes take time to master and contain some difficult passageways, the game can be played at reasonably fast speeds.

You may find the cursor keys difficult to use for movement because they are so close together. Another fault is that the game continues even after you eat the last dot, and you have to wait to be captured, which limits the number of points you can accumulate. But all in all, the game is enjoyable.

★★★

*For more information, circle 7 on reader service card.*

## Déjà-vu

**ZX SCRAMBLE**

*International Publishing & Software, 16K*

The object is to hit enemy installations before they hit you, while simultaneously maneuvering to avoid crashing into treacherous terrain. Unfortunately, the game moves very slowly, and the terrain repeats itself like a chase scene in a poorly animated cartoon. The enemy, seemingly unaware of your presence, fires haphazardly; though I made no effort to dodge enemy lasers, I was not hit once. Some skill is required, however, to move through the terrain (which is like a simple maze) but once you get the general idea, the game becomes monotonous.

★★

*For more information, circle 8 on reader service card.*

## Sleeper

**DEMOLISHER**

*Intercomputer, 16K*

A mass of blocks grows beneath you; points are gained by dropping bombs on particular blocks, and lost by missing. The game ends when the mass of blocks reaches the demolisher. As you have little to do but drop bombs, this game is definitely a sleeper.

★½

*For more information, circle 9 on reader service card.*

## Fast Aliens

**GALAXIA**

*Artic Computing, 16K*

Another alien invasion. You must protect the planet from hostile Thargon forces. The game features a high-score display, dive-bombing aliens, continuous

play, smooth action, fast response, and good graphics. Each time you clear the screen the aliens are replaced, until you deplete your three lives. The game is not easy to beat — the play is fast, complex and unpredictable. Though every explosion is graphically displayed in fine detail (even when you intercept the dropping bombs), some may be put off by the visual display. There are only two types of ships to shoot at but this does not greatly detract from the play. In all this is a fun, challenging and well-executed game.

★★★

*For more information, circle 10 on reader service card.*

## Software Spooks

### MUNCHEES

*Quicksilva, 16K*

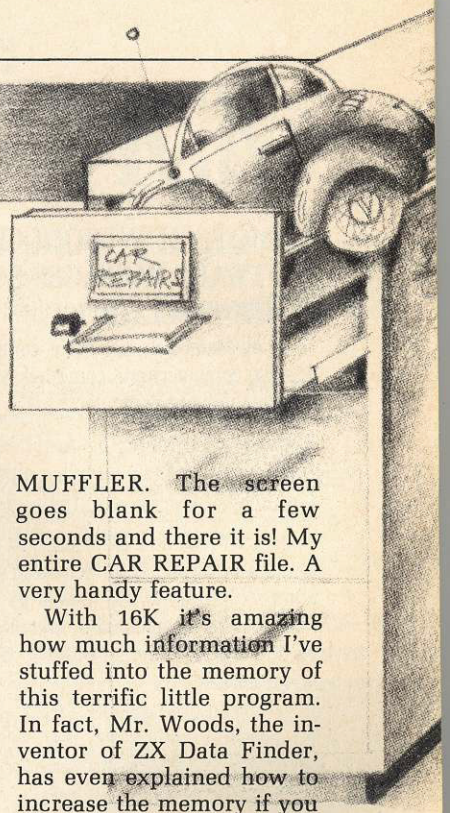
You choose the number (from one to four) of ghosts you wish to evade — the difficulty increases with each additional ghost, and they pursue you with increasing speed in each subsequent play. Though the maze is not adjustable, it is well-constructed and features complicated turns and passages. The keys that control movement (6, 7, 8 and 9) are very close together, causing difficulty during high-speed play. Another slight fault is that you must begin again if you wish to change the number of ghosts. But Munchees is still a most enjoyable game to play — repeatedly.

★★★

*For more information, circle 11 on reader service card.*

*— Reviews by* ***Bob Fraser, Gary Walker*** *and* ***M.K. Wilson.***

## Computerized Filing Cabinet




ZX-DATA FINDER is a storage and retrieval program with some very advanced title and word search features. It is unique because you don't have to set file sizes before you begin. Any length of file can be stored in the same program with no loss of precious memory.

Computer magazines advertise quite a few different data file systems for the Timex Sinclair machine. I have sent for some and, frankly, haven't been very satisfied. For instance there's one called "The Organizer." It works fine — up to a point. The file format has too many limitations. I think a data system needs more latitude.

My business is writing television shows (Happy Days, Mash, and others). Originally I was looking for a data system that would keep my writing files straight: which Mash script had what story line, when it was written, who was in it, what date it was filmed, and so on. Until I found ZX-Data Finder I thought all that information had to be put into one file on one cassette. Not so. Now with one LOAD of my ZX Data Finder cassette I have, in addition to my script information, a running list of all the items that have been repaired on my car, how much they cost, the date they were fixed, a list of magazine and book articles together with their page numbers for research, a file that tells me when I wrote letters and if they have been answered, the dates I've sent for mail-order items and how much they cost, a list of phone numbers, an appointment calendar, and so on. Thanks to the ability to change formats I even have some files with complete calendars for different months with graphic numbers to remind me of important dates! A pretty versatile program. Here's how it works.

Once the cassette is loaded a MENU automatically pops up on the screen and offers you four choices: TYPE A TITLE; ADD a new file; EDIT an old file; or SAVE the new and old data on tape. A quick punch of the "A" key and you're ready to ADD a file. I called one of mine CAR REPAIR. Once this file is setup I have a whole page of 14 lines to write what I want about my car's history: what I did to fix it, how much it cost, the date I repaired it, and so on. (Those garage mechanics aren't going to get me again!) Let's say I enter information that a new muffler was installed on 6/22/83 and it cost $88. I add these facts to the rest of my CAR REPAIR file. Meanwhile, as the days go by, I update my other files as I use them. Now let's say it's been a while since I've needed to access my CAR REPAIR file — (probably not true, there's always something wrong with my car) — but for the sake of this review, let's say I've forgotten the file name. All I remember is I did put a muffler on my car a month or two ago. What do I do? I simply go to the main MENU and answer the question, TYPE A TITLE with the word MUFFLER. I know I don't have a file for MUFFLER but I ask it to SEARCH and FIND the file with the word MUFFLER. The screen goes blank for a few seconds and there it is! My entire CAR REPAIR file. A very handy feature.

With 16K it's amazing how much information I've stuffed into the memory of this terrific little program. In fact, Mr. Woods, the inventor of ZX Data Finder, has even explained how to increase the memory if you have a 32K or 64K RAM. Actually, you only have to change two program lines. I should think, with the additional memory, this data system could be used in some small businesses.

Personally, I've not been able to fill up my 16K. If I *do* get close to filling the memory, a WARNING will tell me to clean out the unused parts of my file while there's still time, another nice touch to this system.

For the technically minded there is a complete listing of the program that comes with each cassette.

Mr. Woods goes step by step through his program and tells you how and why everything works. I should think this feature alone would make a great learning tool. My ZX Data Finder has saved me a lot of time and I've had fun doing it. It certainly has expanded the use of my T/S1000.

***— Dave Ketchum***

★★★★

*For more information, circle 12 on reader service card.*

# SOFT

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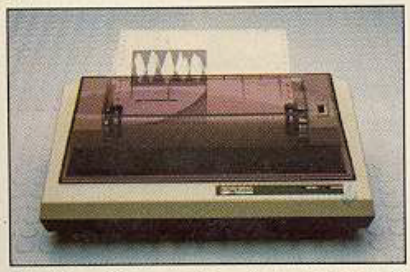

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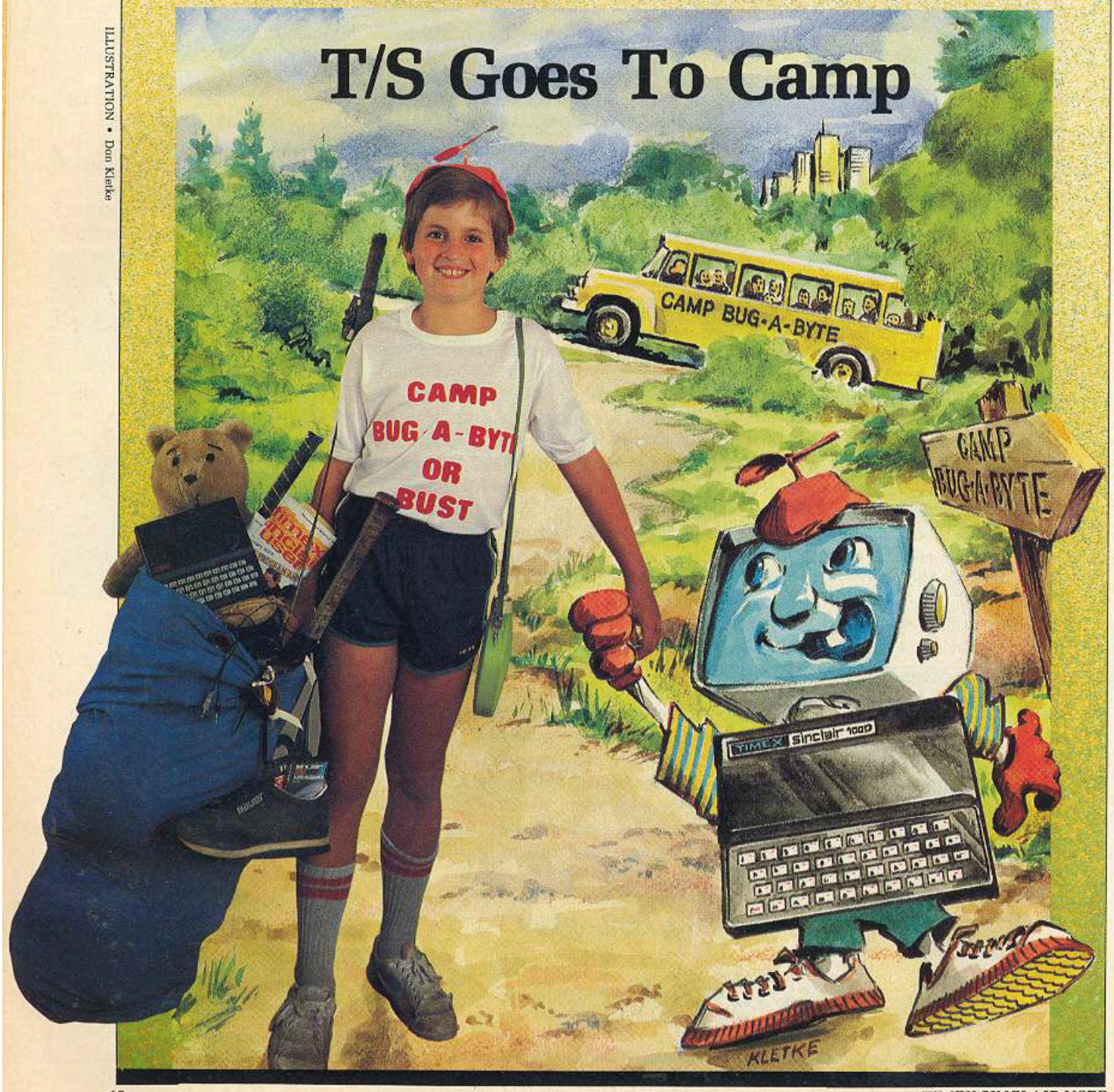
Computing is fast becoming the latest thing in both day and overnight camps, and many camps across the country already include it among their activities. Ellen Vanstone reports on some that feature the T/S1000 exclusively

# T/S Goes To Camp

PHOTOGRAPHY • Bernie Prost

ILLUSTRATION • Don Kletke



AH, SUMMER CAMP. The smell of wood smoke at dusk, the tender-tight feel of a sunburnt nose and tired paddling muscles, the sounds of shouts and splashes from the lake broken only by the electronic beeps from the dining hall.

You know — the dining hall, where the kids work with their computers each morning.

It had to happen. Even the Boy Scouts have been invaded. Their directors are now working with Timex on a program to lead to a Merit Badge in computers.

"People say it's awful, kids are going to start thinking like computers," says Dr. Mark Wasicsko, associate dean at Texas Wesleyan College's School of Education in Fort Worth. "But wait just a minute and think about it. A computer is only a tool, not the answer to life's problems, but a rational analytical tool. Training a kid to use a computer helps him or her become more analytical, precise and better at problem solving."

Wasicsko watched it happen a couple of years ago with his own kids when they begged him to buy some video games. He refused. Then he saw an ad for the T/S1000,ZX81 and bought it with some books and programs so they could make their own games. Wasicsko says his kids sat down with it, figured it out in no time, and now have the expertise to handle just about any computer on the market.

He is now hoping to repeat the experiment with some 200 kids at the Wesleyan Summer Computer Camp, co-sponsored by the college and Timex Computer Corporation.

The camp, for day students only, runs from mid-June to mid-August with 60 kids in each two-week session. Each camper receives a T/S1000 to use at the camp and take home at the end of the session. On the first day there is also a half-hour class in which parents are taught how the computer hooks up to a television set.

The campers keep busy with lessons in terminology, how computers work, applications, BASIC-

language programming, field trips to computer-related agencies, programming contests and, on the final afternoon, a computer fair where they get to show off everything they've learned.

"The first thing we'll do in the morning is answer questions from the homework assignment the kids did the night before," says Wasicsko. "We'll share problems, solutions and discoveries they're making about their computers."

Wasicsko stresses that there will be physical exercise as well, with swimming and sports every afternoon. "We don't want the kids to become hackers or zombies sitting in front of their machines all day."

The cost per camper — $225, which includes lunch, field trips, all materials and the T/S1000 — is kept low thanks to grants from Timex and the college, and due to the fact that none of the faculty are being paid; for them the camp is a training ground where they'll learn to teach computer literacy. Next summer, most will run computer labs in their own schools. By then, Wasicsko hopes to increase the number of sessions at Wesleyan to accommodate more students. "The phone's been ringing off the hook," he says. "Everyone wants to take the course."

> Campers don't just sit in front of computers all day long

Besides teaching kids and training teachers, the Wesleyan camp will also serve to thoroughly test almost every piece of T/S1000,ZX81 hardware and software on the market. "I'm collecting every piece of it I can get," says Wasicsko, "and it'll all be used and evaluated by both kids and teachers."

The reason he chose the T/S1000 in the first place, he says, is the price. "If you want to teach computer literacy, you've got to have hands-on time, and that's directly related to cost." What's more, he adds, "I like it because you can

## More than Electronic Babysitting

### Texan Mark Wasicsko on kids, camps, computers and education

THE MAN behind the camp program at Wesleyan College in Fort Worth, doesn't like to make predictions. But one fact in the future of education Dr. Mark Wasicsko is sure of: computers. "I'm convinced education is going in that direction," he says. "Every state in the country has passed a resolution to aim for computer literacy . . . and the way to achieve it is by training teachers from the elementary level on up."

Wasicsko is doing his bit for the cause by setting up programs to promote computer literacy among teachers at Wesleyan and by running the camps. Now, 33 and associate dean of Wesleyan's School of Education, he's an expert in the field and a well-known advocate of computer education.

"To be honest," he says, "I really don't have much computer background." He briefly encountered FORTRAN as an undergraduate, and later occasionally used a Wang while working at Lockheed, but then left computers while earning a Masters in science education, and a PhD in educational psychology. About three years ago, his two children were clamoring for electronic video games, so he bought and built the Sinclair Kit and started reading — about 50 to 100 books on computers and programming in general plus every book available on the T/S1000. Now completely won over to the ways in which computers can enhance education, Wasicsko is also aware of the larger picture: "There's a fear that by neglecting computer education in our schools, we'll be losing out to other countries — Japan, for instance — where they're available to all students."

Cost is one problem here, says Wasicsko (though he thinks the low-priced T/S1000 is a breakthrough), but even in schools that can afford computers, attitude can be a problem. "A big disappointment to me is that many teachers are only interested in computer-assisted instruction — prepackaged software so they can let the kids play games. Basically all they want is electronic babysitting, which to me is not the answer. The best use for computers is for kids to learn how they work, how to program them and use them for problem solving."

There is no shortage of student teachers who feel the same way. "The teachers who'll be running this summer program are an exciting group — they'll be trying out all kinds of teaching on the computers: English, social studies, math . . . By the end of camp, the kids'll probably know more than they do.

"It's not that the teachers are stupid," he hastens to add. "But kids just seem to be able to walk up to those machines and pick things up in no time."

With people like Mark Wasicsko around, it's likely a lot more kids each year will get the chance.

— *E.V.*

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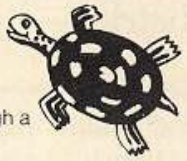

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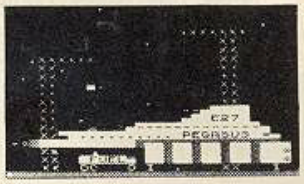

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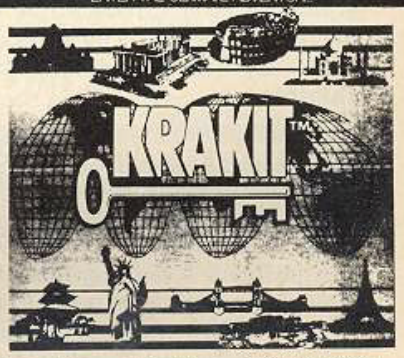


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teach an entire math course on it — from pre-school to college calculus, or grammar skills by using it as a word processor. Another thing about the Timex Sinclair is that once you know how it works, it's easy to move on to other machines, which is not true the other way around."

Ken Hollandsworth, an educational consultant for Timex, has a keen interest in the Wesleyan camp. "Mark is one of several leading educators we're working with," he reports. "Our plans are ambitious and growing — we've got camps in Florida, Texas, Pennsylvania, Connecticut, Massachusetts and Delaware."

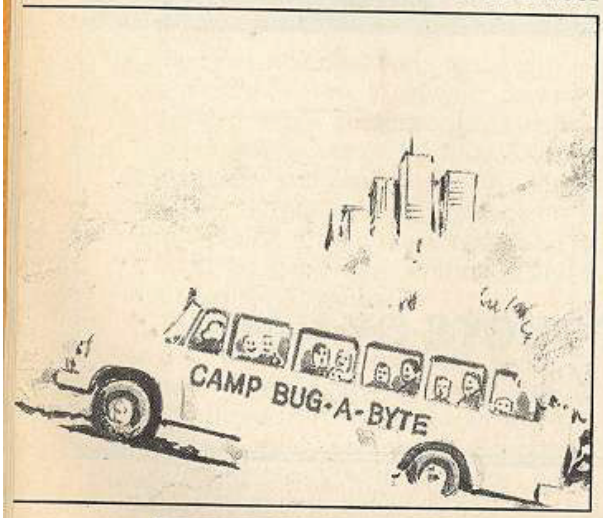
He explains that the Wesleyan camp is specifically integrated with the college's teacher-training program, but cites other camps where the main purpose is to increase computer literacy among school children.

"In Florida alone we're expecting 15,000 kids to go through camps set up in 80 different school districts."

The man behind the Florida program is Dr. Martin Ryder, head of the graduate school of education at Rollins College in Winter Park.

"We started out by sending letters to 800 Parent-Teacher Associations across Florida asking if they were interested in setting up summer camps," he says. "Within two weeks 45 schools signed up and we're getting more each day."

Three teachers from each school have been training at Rollins on the weekends in preparation to teach at the camps. They are learning such basics as programming, simple plotting and account statements, curriculum development and instruction.




**In Florida alone, 15,000 kids are expected to attend camps in 80 school districts**

All the camps are day camps with three hours of instruction in either the morning or afternoon. The cost is $60 per week and kids can sign up for two to six weeks. Individual computers are supplied by Timex and will be sold at a discount at the end of each session. Administrative support is financed by a group called CACI (Ryder says the letters no longer stand for anything), an organization that has a contract with Timex to be the educational distributor of the T/S1000,ZX81.

"The neat thing," says Ryder, "is that the camps are so cheap and accessible for kids — they're all within walking distance or easy transportation."

Another boost for the program, says Ryder, is that the state of Florida takes computer literacy very seriously. "There's now a mandate on the legislative docket that students be required to have at least one semester of computer instruction prior to graduation."

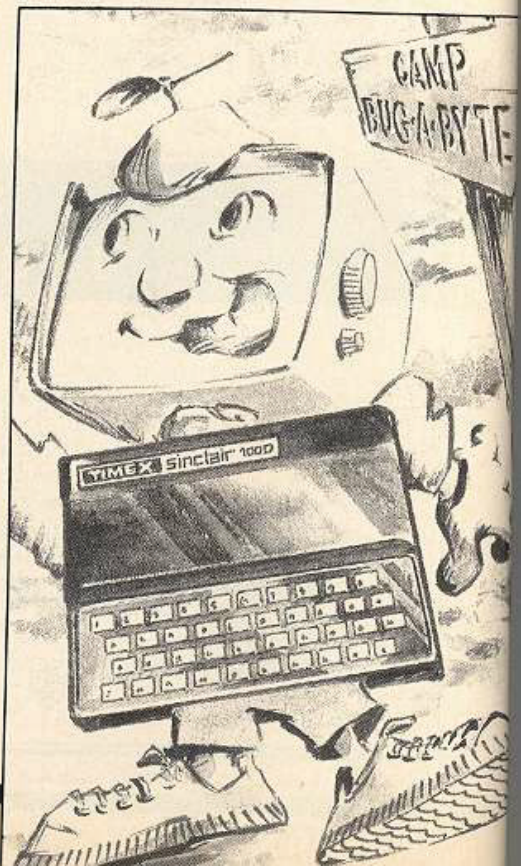
Meanwhile, in Connecticut, a pilot program involving Timex and the Taft Educational Center in Watertown is offering a two- to four-week program for both day and overnight campers from all over America.

Director Edward North describes the program as primarily a laboratory for teachers to learn to teach on a computer, like the one at Wesleyan.

As for the campers, "the program combines computer training with field biology," says North. "The T/S1000 interfaces well with lab equipment — you don't need much more than a 16K memory — and kids will learn that a computer in the laboratory has many uses."

Morning classes will teach BASIC programming to beginners and computer applications to more advanced students. Afternoon activities include biological science studies in the surrounding countryside plus games, tennis and swimming. As in the Florida camps, the machines are supplied by Timex and will be sold at a discount at the end of the camp.

If other educators across the country are interested in setting up similar camps, Hollandsworth says he is prepared to supply information and operating assistance. "If people are sincere and the program is an ambitious one, we can even send out Mark (Wasicsko), Marty (Ryder) or Ed (North)," he suggests. Anyone who wants to take up his offer should write to Ken Hollandsworth, Timex Computer Corporation, P.O. Box 2655, Waterbury, Connecticut 06725.



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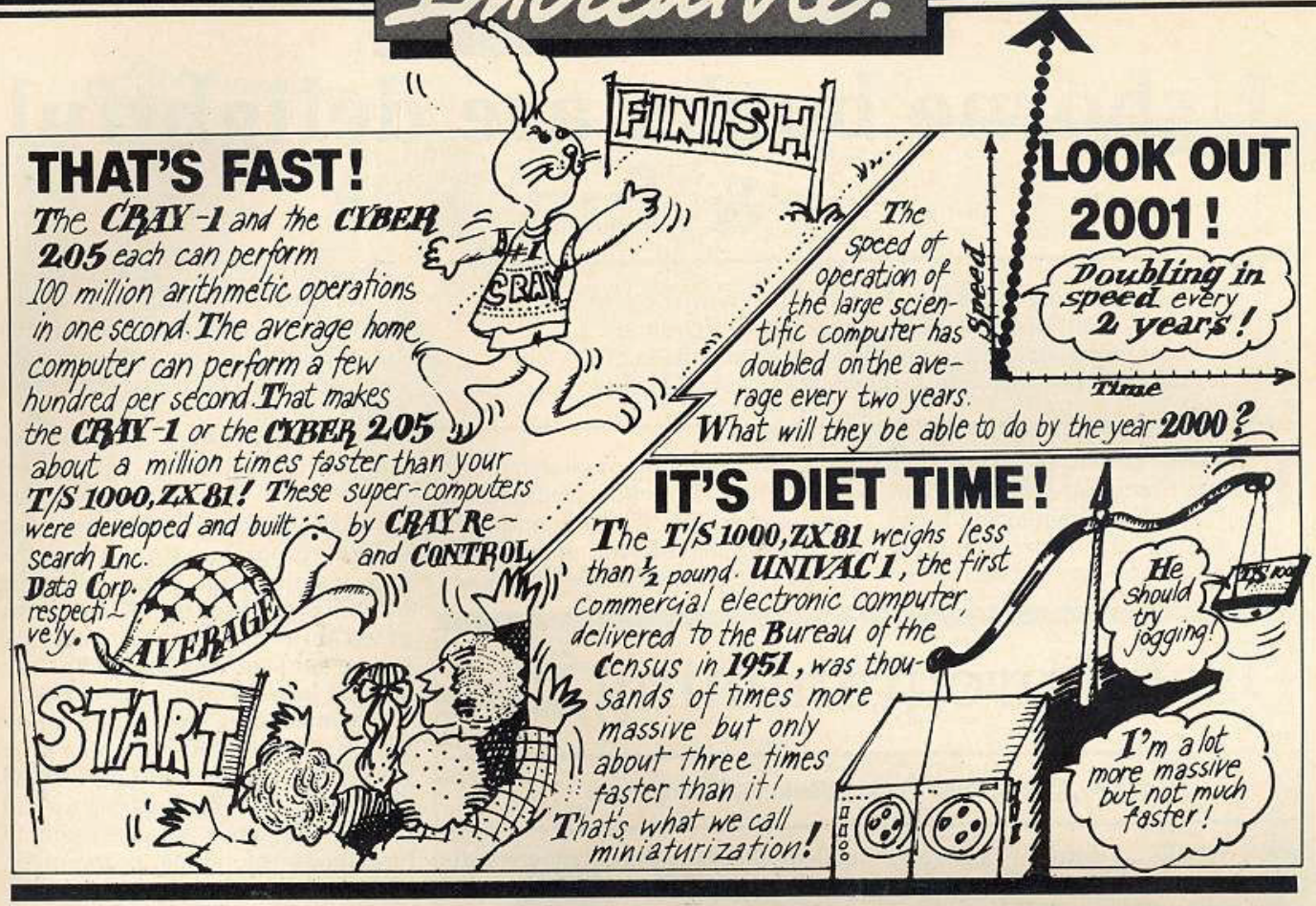


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# Usborne books are delightful & fun

***Understanding the Micro,*** *by Judy Tatchell and Bill Bennett*
***Computer and Video Games,*** *by Ian Graham*
***Computer Spacegames,*** *by Daniel Isaaman and Jenny Tyler*
***Computer Battlegames,*** *by Daniel Isaaman and Jenny Tyler*

I HAVE A FRIEND who suffers from computer-phobia — fear of the chip. Whenever I try to interest him in a programming career, he replies, "I can't learn that stuff. It's too complicated."

Recently, I invited Dean to my home, gave him *Understanding the Micro* and a cold beer, and left him at the dining room table.

Ten minutes later, Dean came into the den and exclaimed, "Hey, Warren! This is great! I already know the difference between software and hardware and RAM and ROM."

Two hours later, we were intelligently discussing computers. Next, Dean was sitting at the keyboard of my T/S1000, entering sample programs from the book and making runs. The following morning he was at the offices of our programming group, entering games into an expanded T/S1000. He had lost his computer-phobia!

*Understanding the Micro* is a profusely illustrated, step-by-step guide that does not get bogged down in confusing technical jargon. The book is alive with illustrations of chips, computers, and hundreds of tiny robots that are as delightful as they are colorful.

By page 12, the reader is given information on writing programs; by page 14, you're taught to type, run and debug them.

Then we take a visual tour of the inside of a chip. The illustration of the inside of the ROM is especially clever. Three robots are depicted in a library-like atmosphere. The "interpreter" robot is reading pages of printed matter (code) with a "PEEK" robot looking over his shoulder. Across the desk a "monitor" is transcribing data onto sheets of paper.

The rest of the book is devoted to illustrations telling the history of micro-computers, networking, using the modem, control functions of computer applications, graphics, printers and plotters. Finally, there is a buyer's guide, a glossary of micro terms and an index.

*Computer Battlegames* contains programs for the T/S1000 and the ZX Spectrum (soon to be the T/S2000) and other computers, including Robot Invaders by Bob Merry, Secret Weapon, Shoot-out, Desert Tank Battle and Iceberg. By

# Useful programming tips

***The ZX81/Timex Pocket Book,*** *by Trevor Toms*

TOMS book is very readable. Besides the clear style, the text and program listings are laid out in a format that is easy on the eyes. Each chapter is illustrated by a very nice piece of graphics. Beyond the welcome esthetic value, these drawings help break up the book, keeping it from seeming like an endless monotone of PEEKs, POKEs and INPUT routines.

Budding programmers will really appreciate the third chapter. As you know, efficient programming is an absolute must with the little T/S black box. With limited memory, programs must be compact. But what if you're new to computers, like most of us using the Timex, and don't know all the special techniques? This text addresses that problem. There are 12 pages of advice on what and what not to do. A very special chapter tells you how to write a program using the least amount of memory and still make it run fast-fast-fast.

Most of the book is devoted to 12 programs, including Ski-Run, Paint-a-Pic, Digital Clock, Jaws and City of Alzan, an adventure game. Besides the main program offerings, a number of mini-programs called "Stocking Stuffers," are scattered throughout.

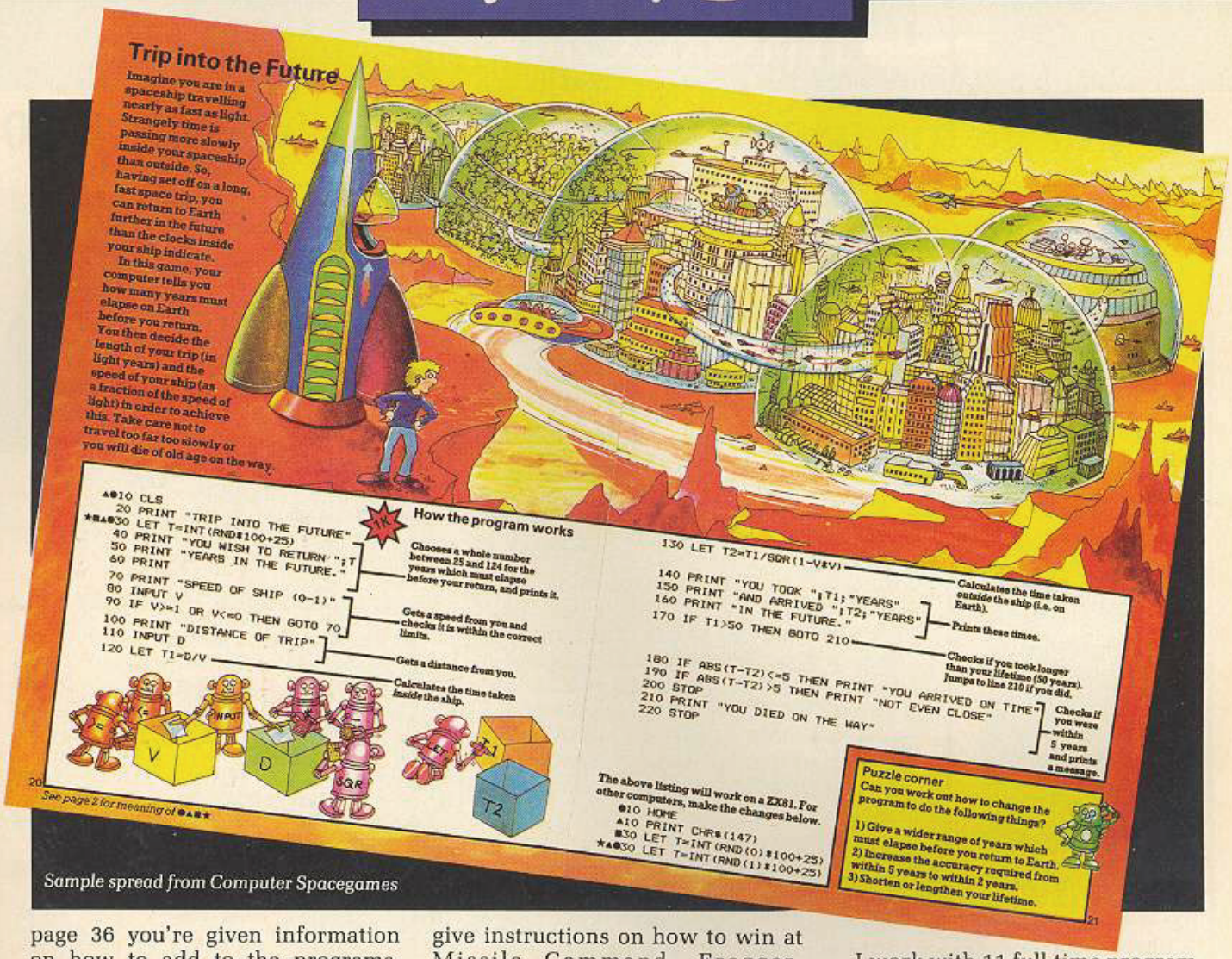
If bored with BASIC, there's a nice overview on how to use machine code. It won't teach machine code, but it's a good introduction.

The back of the book has the usual set of appendices: perhaps the most informative tells how to convert old ZX80 programs to the new format. What good is that if you have a T/S1000 and have never even seen the old ZX80? Simple. Want some free software? Scout out old magazines at garage sales and flea-markets. Obviously, you're only interested in those which cater to Uncle Clive's machine. When you see a program written for the ancient ZX80, use the appendix in this book to translate it to your machine's specifications.

Also tucked away in the back are some very important tidbits of information on what makes the little black box tick. The information details memory organization, data and address lines as well as a clear definition of what each BASIC command causes. If you've ever tried to wade through the user's manual, you understand the value of this.

***— Tim Banse***

# Books




*Sample spread from Computer Spacegames*

page 36 you're given information on how to add to the programs, such as by using sound effects. Next, there is a clearly illustrated guide (those little robots again!) to writing your own programs, an illustrated summary of BASIC, and answers to puzzles printed alongside each program. Illustrations are often in four colors and they're excellent.

*Computer Spacegames* follows the same format as the *Computer Battlegames* but features games like Starships Takeoff, Evil Alien, Asteroid Belt, Monsters of Galacticon, and such little touches as "How to make the game harder," and the "puzzle corner."

*Computer and Video Games* is another illustrated guide to this subject. You're shown how arcade and computer games work, how they make sound effects, and how computers play chess.

Special sections on some pages give instructions on how to win at Missile Command, Frogger, Asteroids and other popular games. You're shown how games are made, their history, and the future of games.

The authors point out that the ultimate game will be a super-"realistic" computer simulation

> "Understanding the Micro could have saved me six months"

which takes place all around you in a special games cubicle. The game, perhaps a space invasion or adventure game, will have three dimensional effects, laser lighting and quadraphonic sound.

I'll bet five-to-one that Nolan Bushnell, founder of Atari, is working on just these kinds of games in his new company in California.

I work with 11 full-time programmers and another 52 on special projects. I sought an opinion on these four titles from every programmer who came in during a four-day interval. Their response was enthusiastic — wildly so. One self-taught programmer said, "I could have saved six months getting started if *Understanding the Micro* had been available to me."

The books were beautifully designed by Graham Round and Roger Priddy. Because of the power of the illustrations, a blip of the chip should also go to the artists, who are too numerous to name.

The books have been selected for certain B. Dalton Bookstores. They have been relegated to the children's book section, but don't let that bother you. These books are for anyone seeking a clear understanding of computers.

***— Warren Smith***

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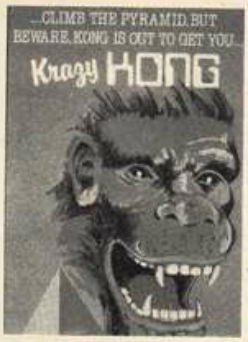


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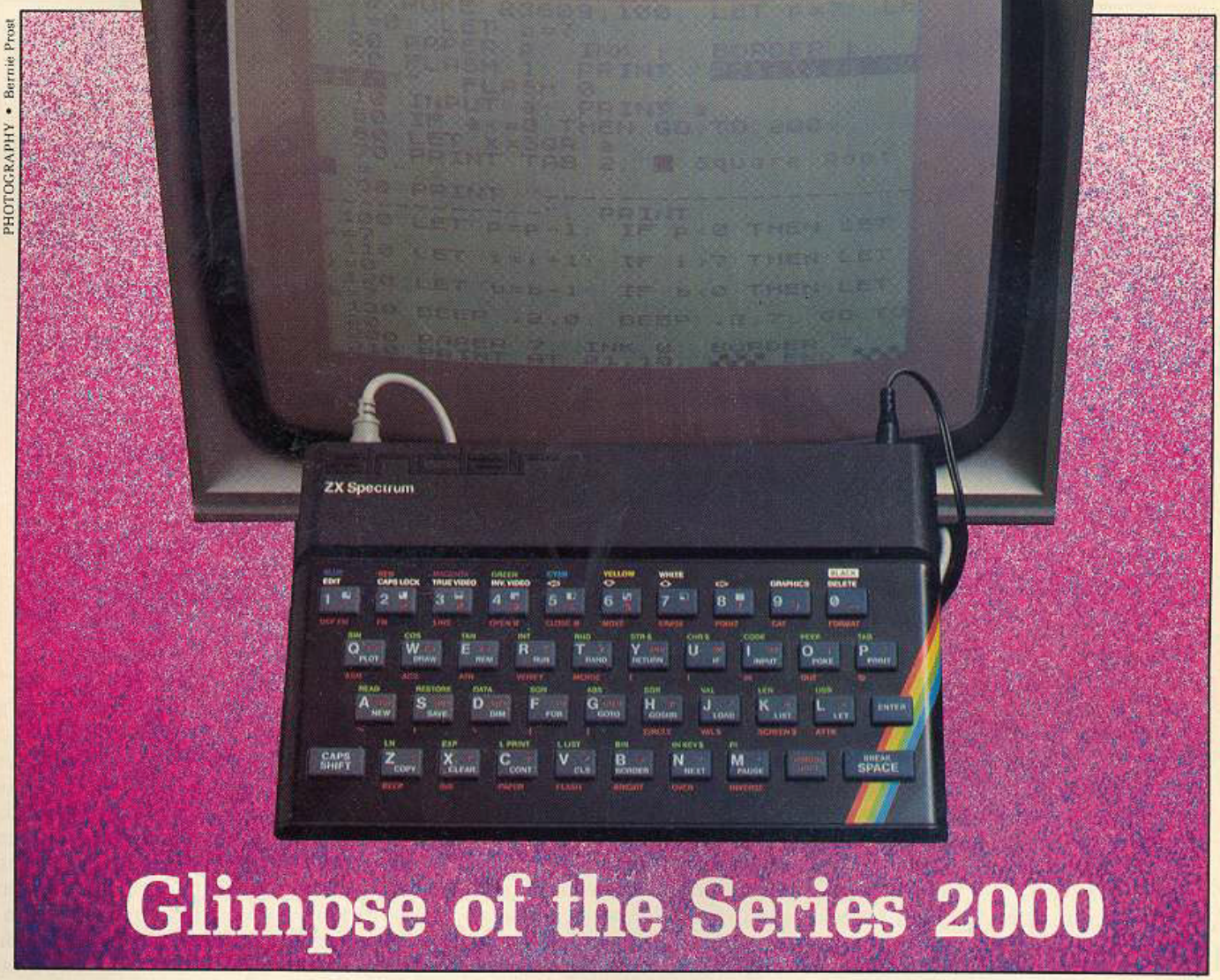


PHOTOGRAPHY • Bernie Frost

# Glimpse of the Series 2000

## To give you a head start on the Timex Sinclair 2000-series color computer, Fred Blechman explains how to use the keyboard of its prototype, the Spectrum from Sinclair

IF YOU own a T/S1000,ZX81, you know how puzzling the keyboard is until you get used to it. Many functions take two keys or a special sequence of keys. Well, the Sinclair Spectrum — the big brother to the T/S1000,ZX81 — has a keyboard with the same number of keys but more than 30 additional commands and statements. Among this extraordinary computer's additional features are color, sound, lower-case characters, 16 or 48K RAM built in, special graphics and flashing characters. If you like the T/S1000,ZX81, you'll absolutely love the Spectrum, T/S2000 — once you figure out the keyboard!

Although the Sinclair Spectrum is referred to in this article, the Timex Sinclair 2000 (due to be released soon) is expected to have a very similar keyboard and the same BASIC language — so, if you don't have a Spectrum, hang onto this article until you get your T/S2000!

The first thing you notice about it is that it has keys that push down but are not full-stroke like a regular typewriter's. The keys feel odd to the touch since they have a gray rubber coating and can rock when pressed. Their rectangular shape and rounded tops have inspired people to call them 'chiclet keys'.

Most keys have at least three legends on them in white and red, with additional legends on the keyboard surface in white, green or red above and below each key. There are also additional color legends above eight keys on the top

row. The result is a great mystery to the uninitiated but really very simple for those "in the know." With the information in this article, you'll have the keyboard under control. However, using the keyboard is really a lot simpler than *explaining* how to use it . . . so this article may appear more complex than it really is.

I'LL use a simple program as a training device to familiarize you with the keyboard. This program (see the listing) does not use all of the keyboard legends, but does use most of the combinations you'll encounter when you enter your own programs. The keystrokes to enter this program into a Spectrum will be detailed — and you'll end up being able to determine the square root of a number, with color and sound illustrating some of the programming potential. As an added bonus, I'll explain what each line in the program does, so you'll learn a little "Clive BASIC" programming as well.

## The Cursor

The cursor is a single character in blinking video on your screen at the location of your next entry, usually somewhere along the bottom two screen lines. The Spectrum has *six* different cursors to tell you the computer "mode." The K-cursor tells you a "keyword" is expected next. A keyword is a word or abbreviation printed in white or red on the keys. The L-cursor tells you that a character or symbol is expected next. These will be capital letters if you hold the CAPS SHIFT key down or various symbols and punctuation (printed in red on the keys) if you hold the SYMBOL SHIFT key down. The C-cursor tells you the computer is in the CAPS lock mode — you get there by holding down the CAPS SHIFT key and pressing the 2 key (CAPS LOCK) once. The E-cursor indicates the next entry will be a keyword printed above the keys in green (unshifted) or below the keys in red (symbol-shifted). The G-cursor tells you the computer is in the graphic mode to access the symbols on keys 1 thru 8. The ?-cursor appears whenever you make an error in a program line entry and press ENTER. The ?-cursor pops in right where the error is! The line will not be accepted into the program until this error is eliminated, or the line deleted.

The ?-cursor appears at the location of the error

Confused? Sure you are. But it will clear up as we enter the program. Before we go any further, however, you should know how to delete keyboard entry errors. Easy. Just hold down the CAPS SHIFT key and press the 0 key in the upper right hand corner of the keyboard. Every keypress of the 0 will backspace the cursor, deleting that character. Also, you must adjust to the fact that there are *two* shift keys on the Spectrum: CAPS SHIFT is used to access the white functions and arrows shown directly above the top row of keys, SYMBOL SHIFT, to access the red keywords

and symbols *on* the keys. When both shift keys are pressed together, the E-cursor is generated and the next keystroke is the green function *above* the keys or, if the SYMBOL SHIFT key is also held down, the red function shown *below* the keys.

### Let's Get Squared Away!

Let's enter the Square Root program into the Spectrum. Get the computer up and running following the instructions in the manual. The video screen should display only the Sinclair copyright message on the bottom line. Adjust the brightness, contrast and tuning for the sharpest picture. If you're using a Spectrum on an American or Canadian black and white television, you probably will also have to adjust the vertical hold. (The Spectrum is made in the United Kingdom, where the PAL color television signal is different from and incompatible with the American and Canadian NTSC color signal, so a Spectrum will not produce color on a North American set. The T/S2000, however, will be redesigned for American and Canadian color television.)

Follow me as we enter the program line-by-line, keystroke by keystroke:

**Line 10:** Press the 1 key, then the 0 key. Notice how the K-cursor has appeared, and moves to the right with each keystroke. Now press the letter O key, which has the white word POKE printed on it. This keyword now appears on the screen, with a space both before and after it, and the cursor changes to an L, since letters or numbers usually follow a keyword. Next press the 2, then the 3, 6, 0 and 9 keys. As you press each the number appears on the screen and the cursor moves to the right. Next you need to enter a comma. If you check the N key, you'll find a comma in red. Since it's in red on a key, you need to press SYMBOL SHIFT to access it. So hold down the SYMBOL SHIFT and press the N key and the comma magically appears on the screen. Now press 1 and 0 and 0 in sequence and you have the first part of line 10. What does POKE 23609,100 do? On the Spectrum, it provides a short audio tone when you press a key. Want to prove it? Hit ENTER and line 10 (as much as you've done so far) will appear at the top of the screen. Now press the R key and the word RUN will appear at the lower left corner of your display. Press ENTER and you have run your first program! What did it do? It entered the POKE into the computer memory — and from now on when you press a key it will beep when the computer acknowledges receiving it.

> The rounded, rectangular keys resemble Chiclets

Look at the screen. Blank, except for 0 OK, 10:1 at the bottom. That means no errors, program okay, and last statement executed was the first statement in line 10. That's called a 'report,' and the Spectrum gives very meaningful reports. Now what? Well, you should continue line 10, since there's more to enter. Since line 10 was the last line entered or executed, it is the "current line," and you can EDIT it by simply holding down CAPS SHIFT and pressing 1 (which has the white word EDIT above it). Line 10 appears at the bottom of the screen, with a blinking K-cursor following the line number. Since you want to add more characters at the end of this line, you must move the cursor to the end of the line. Do this by holding down CAPS SHIFT and pressing the 8 key (which has a white right-arrow above it). The K-cursor changes to an L-cursor and moves to the right as you press the 8 key. Hear the beep? Also, notice how the cursor jumps over the whole word POKE since it is a keyword? Move the cursor back and forth along the line with the left-arrow (5) and right-arrow (8) keys, remembering to hold down CAPS SHIFT. Finally, move the L-cursor to the right end of the line. Press SYMBOL SHIFT and the Z key and you'll get a colon (:). This tells the computer you want another statement on that line. The cursor, knowing that a keyword must be next, has changed to a K. How's that for smart?

> The Spectrum has six different cursors

Now press the L key for LET, then the P key. Hmmmm. That's a small p — lower-case. Don't worry about it. This is a "variable," and the Spectrum does not distinguish between upper case and lower case variables. Now press SYMBOL SHIFT and L for the equals sign, then the 7 key. Now SYMBOL SHIFT and Z for the colon, then SYMBOL SHIFT and L for LET, followed by I, SYMBOL SHIFT and L, then 0. Similarly, program :LET b = 7 into line 10, then press ENTER.

### Keystroke Notation

Whew! All that for one line? Seems tough at first. I'll summarize by using some simple notation. C-SHIFT will mean CAPS SHIFT, S-SHIFT will mean SYMBOL SHIFT. I'll use commas to separate keystrokes. Line 10, using this notation, would be as follows:

1, 0, 0, 2, 3, 6, 0, 9, S-SHIFT N, 1, 0, 0, S-SHIFT Z, L, P, S-SHIFT L, 7, S-SHIFT Z, L, I, S-SHIFT L, 0, S-SHIFT Z, L, B, S-SHIFT L, 7, ENTER

You've entered four statements on one line, incidentally, something that would take four program lines on a T/S1000,ZX81. You have POKEd for keyboard feedback and set variables p, i and b to initial values.

**Line 20:** Press 2, then 0. Now we get into the use of the E-cursor. Hold down *both* C-SHIFT and S-SHIFT and the K-cursor changes

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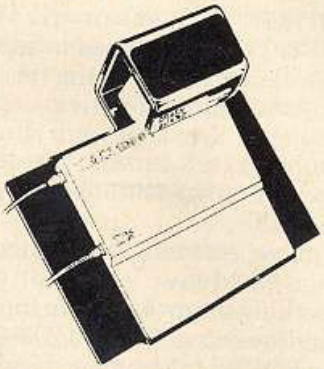

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to an E-cursor — for one keystroke only. Every time you want an E-cursor you must press *both* shift keys. If you get an E-cursor by mistake, press both shift keys and it will toggle back to whatever cursor it was. Okay, so now you have the E-cursor blinking at you, and you want the word PAPER, which is printed in red under the C key. Red — hmmmm. Must mean the S-SHIFT key is needed. Right! Hold down S-SHIFT, press C and you've got PAPER on the screen. Now press P. Here are the rest of the keystrokes for line 20:

S-SHIFT Z, C-SHIFT S-SHIFT, S-SHIFT X, I, S-SHIFT Z, B, B, ENTER.

This line establishes the initial colors for the paper (user screen area), ink (printing) and border (outside user screen area) with the values from line 10. As shown on the keyboard, 0 is black, 7 is white.

**Line 30:** This line will print a flashing "prompt" on the screen when the program is run. The prompt is in "inverse video." Start with: 3, 0, C-SHIFT S-SHIFT, S-SHIFT V, 1, S-SHIFT Z, P, S-SHIFT P.

Now you need to get into inverse video. Look above key 4. There it is in white. Hold down the C-SHIFT key and press 4 and you are now in inverse video, even though nothing seems to have happened. To get back to true video, you'll use C-SHIFT 3 later on. Here's the rest of line 30:

C-SHIFT P, O, S, I, T, I, V, E, SPACE, C-SHIFT N, U, M, B, E, R, C-SHIFT 3, S-SHIFT C, S-SHIFT P, S-SHIFT Z, C-SHIFT S-SHIFT, S-SHIFT V, 0, ENTER.

**Line 40:** This line allows you, when the program is running, to enter any positive number from the keyboard. Nothing really new here. The keystrokes are:

4, 0, I, A, S-SHIFT Z, P, A.

**Line 50:** This line lets you end the program by entering 0 or a negative number. The funny left-arrowhead-equals sign means "less than or equal to." The keystrokes are:

5, 0, U, A, S-SHIFT Q, 0, S-SHIFT G, G, 2, 0, 0, ENTER.

**Line 60:** This line does the calculation of the square root.

6, 0, L, X, S-SHIFT L, C-SHIFT S-SHIFT, H, A, ENTER.

Note that the E-cursor is used to access the SQR above the H key, but *not* shifted since it's in green above the key.

> The Spectrum accepts variables in upper case or lower case

**Line 70:** This line prints the value of the square root, and uses the graphic square that appears on the 8 key. The keystrokes for the beginning of the line are straightforward:

7, 0, P, C-SHIFT S-SHIFT, P, 2, S-SHIFT 0, S-SHIFT P.

But how do you get the graphic square on key 8? The word GRAPHICS is in white above the 9 key, so hold down C-SHIFT and press 9. The G-cursor appears. Now hold down S-SHIFT and press the 8 key and there you have it! But now you need to leave the graphics mode. Hold down C-SHIFT and press 9. The cursor returns to an L. Here's the rest of the line:

SPACE, C-SHIFT S, Q, U, A, R, E, SPACE, C-SHIFT R, O, O, T, SPACE, C-SHIFT 9, S-SHIFT 8, C-SHIFT 9, SPACE, S-SHIFT L, SPACE, S-SHIFT P, S-SHIFT O, X, ENTER.

**Line 80:** This prints a dotted line across the screen, then a blank line. The keystrokes:

8, 0, P, S-SHIFT P, S-SHIFT J (32 times), S-SHIFT P, S-SHIFT Z, P, ENTER.

Note: With the Spectrum you can hold down any key and it will repeat after a short delay. Try doing this to enter the 32 dashes.

## Modular Programming

**Line 100:** What happened to line 90? There isn't any. You don't need to use all line numbers, or any special interval between them. "Modular programming" uses numbers in blocks. In this case lines 10 through 80 have really executed the program. Now the program will change the colors and do it again. This line decrements (decreases the value of) variable P by 1 and checks to see if it has gone below zero. If it has, it resets it to 7. Here it is:

1, 0, 0, L, P, S-SHIFT L, P, S-SHIFT J, 1, S-SHIFT Z, U, P, S-SHIFT R, 0, S-SHIFT G, L, P, S-SHIFT L, 7.

**Lines 110 and 120** do the same sort of thing for variables I and B. The combination of lines 100 thru 120 changes the PAPER, INK and BORDER for each square root calculation. The keystrokes are so similar to line 110 it's not necessary to repeat them.

**Line 130:** This line produces a two-tone sound at the end of the calculation and before the colors change. Keystrokes are:

1, 3, 0, C-SHIFT S-SHIFT, S-SHIFT Z, S-SHIFT M, 2, S-SHIFT N, 0, S-SHIFT Z, C-SHIFT S-SHIFT, S-SHIFT Z, S-SHIFT M, 2, S-SHIFT N, 7, S-SHIFT Z, G, 2, 0, ENTER.

The GO TO 20 returns the program for color changes and another calculation.

**Line 200:** This line returns the colors to normal (PAPER white, INK black, BORDER white) before ending the program. You should be able to enter this by now without individual keystroke notation.

**Line 210:** This line ends the program by printing END, with graphic characters, on the last user screen line. The only tricky part here is that the same graphic is used (key 6) both before and after the word END — but if you look closely you'll see that they are the reverse of each other. This is done with the INV.VIDEO command above key 4. That should be all the hint you need to enter this line for your "final exam."

ONCE you've entered the entire program, RUN it and watch the screen colors change with each calculation. If it doesn't run properly, check each program line very carefully with LIST (on the K key). "Debugging" is great for learning programming . . . and will keep you humble!

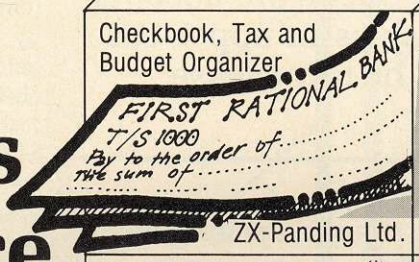
# Let this software help you run your home

## Joseph Gladstone evaluates home management software

I AM definitely not good at budgeting, money management, fiscal organization — call it what you want, I'm not good at it. Obviously, I am not alone in this because there are a great number of programs for the T/S1000,ZX81 designed to help me organize my money, books, records, coupons and just about anything else you can name.

For this Focus I review and compare four programs specifically designed to help me manage my money; one to set my home files straight (birthdays, recipes, phone numbers, and so on) and one full 16K program just for all those bonus coupons that accumulate. Every program was worth the money — each did what it said it would do, and did it well. There were a few minor problems, none serious and none that prevented me from enjoying the programs. And I didn't have to be a bookkeeper to use any of them!

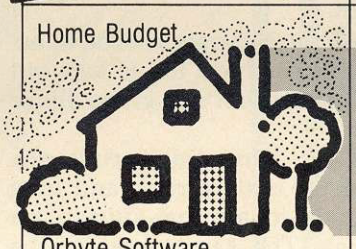
### Checkbook, Tax and Budget Organizer




ZX-Panding Ltd.

THIS program is ideal for managing your bank account and checkbook. Checks can be listed, recalled and totalled by number, name or ledger entry. Then ten jobs that this program performs are all accessed from a menu that is displayed by pressing GOTO 50 after LOADing. You can store more than 100 transactions with a 16K RAM and up to 1,000 with a 64K RAM. To keep your files up to date simply save one month at a time. There are 12 pre-set headings from business expenses to miscellaneous. You can use these or make up your own.

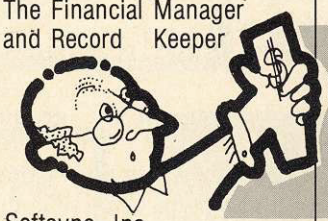
### Home Budget



Orbyte Software

IF you want to organize your spending habits this is the program for you. It starts with 39 pre-set categories that cover everything we can think of. If you wish to change any of those categories, that option is open also. You have a choice of going through the categories one at a time or choosing the specific one you want to analyze or add or delete information from. After you have entered your budget you enter your actual expenses. The program then analyzes the two sets of data for you and will display that analysis as a graph or a set of compared figures. This program does the job it sets out to do and does it well to boot!

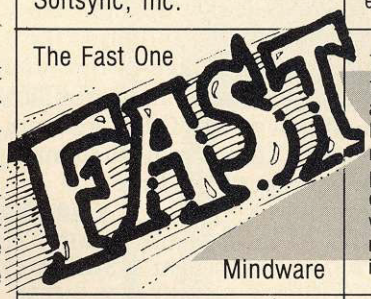
### The Financial Manager and Record Keeper



Softsync, Inc.

HERE is a program that is well set up for you to keep track of your expenses and income. Further, it will tell you what per cent of your income each expense constitutes and it does this on a monthly and yearly basis. Then, if you want, you can have all your information presented by category or by month. When the program begins, you set up a starting date which is useful for filing your data for future reference. The SAVE instructions were particularly well set out allowing you to SAVE your new data (press R) or clear the data (press C) or return to the menu (press P). A well designed program!

### The Fast One




Mindware

THIS program is ideal for setting up lists of information. You could file phone numbers, records, recipes, addresses, credit cards or any other set of material that is listable. It was written for a business to keep track of mailing lists, catalogs, inventories, client records and other business data. It is as advertised, a "computerized filing cabinet". It is extremely well-documented and quite easy to use. The program features the Quickload system which puts this 16K program into the computer in under two minutes. This program is excellent for filing and retrieving lists of information.

### Home Money Manager

THIS home budgeting system allows you to input 14 of your own categories, 11 expense items and three income items. You can keep track of your budget on a monthly basis, then do a month by month or full year balance sheet. The program is well documented and easy to use. As with the others, no special computer or bookkeeping knowledge is needed. The seven option menu is well-presented, making each section of the program readily available. The categories are changeable and each can be accessed individually. A well set up screen for each section makes this program easy and enjoyable to use.

### The Coupon Manager

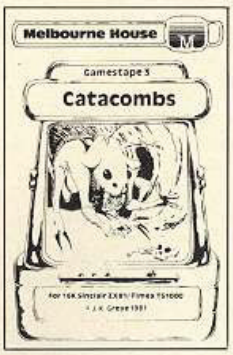
Timex Computers

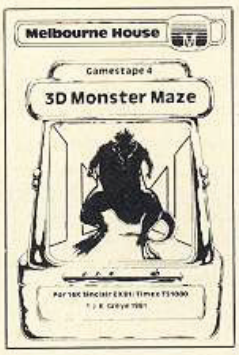
THE Coupon Manager program lets you store and retrieve store coupons. We all have dozens of these discount coupons everywhere in our wallets, homes, purses and cars. Now you can file them. This program gives you 18 different categories for your file system. It keeps track of when coupons become outdated and which store honors them. You can list the coupons by store, category or date. Now, as Timex says, when you're ready to go out on a shopping spree you can flip through your file of coupons and pick out the ones you want. It is easy to use and well designed. It keeps good track of your coupons — but it's up to you to remember where you left them.

# Focus

| Loading | Self-Starting | Opening Screen | Documentation | Preset Categories? | Packaging (1-10) | Main Area of Use | Problems? | Suggested Correction | Best Feature | Service Card # |
|---|---|---|---|---|---|---|---|---|---|---|
| 4½-min., no problems | No | none | clear 4-pg. booklet | no | 6 | checkbook balancing | no clear instruction on how to get going after LOADing | make the program self-starting | excellent save frame — lets you return to the menu in case of error | 22 |
| 6½-min., no problems | Yes | 4-item menu ready to start | inadequate | yes/39 | 6 | budget planning | no clear instructions on saving the tape | put some information on the screen before going into the SAVE mode | graphs a comparison of acutal and planned budget | 23 |
| 5½-min., no problems | Yes | clear, simple, well laid out | inadequate | yes/19 | 6 | budget planning | couldn't get out of option 4 unless I made some changes — what if I didn't want to? | allow an exit option for each menu choice | gives 19 good categories all set up — lets you start the program very quickly | 24 |
| 2 min., no problems | Yes | 10 instruction codes and their meaning — easy to start | excellent | yes/n.a. | 6 | lists | not specific to household use | put a section in the guide that explains how to adapt it to home | excellent documentation | 25 |
| 5½-min., no problems | Yes | starts at menu, clear instructions | good | no | 8 | budget planning | quit to menu message not given often enough — I forget! | print the options open to user on the screen when needed | before you can clear a month's or year's entries, the machine checks with you | 26 |
| 6 min., loaded on second try | Yes | 18 coupon categories — we didn't know there were so many | good | yes | 7 | coupon organization | too many inputs needed for simple changes | simplifying the program a bit | recalls your coupons | 27 |

# DON'T TAKE OUR WORD FOR IT... READ THE REVIEWS:



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**GAMESTAPE 3 – CATACOMBS**
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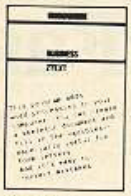

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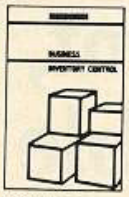

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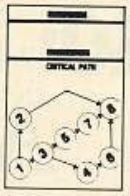

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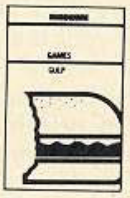

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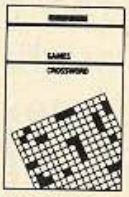

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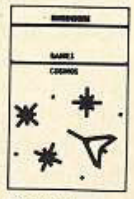

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# The 2040: Efficient, Fast and Affordable

## Fred Blechman evaluates the Timex Sinclair printer

WHEN the Sinclair ZX81 was originally introduced into the United States by mail-order, the magazine ads promised that the ZX Printer — for less than $100 — would soon follow. That didn't happen, according to hearsay, because the radio-frequency interference (RFI) from the printer exceeded Federal Communications Commission (FCC) minimums. The ZX Printer uses electrostatic printing, whereby a moving head uses voltage pulses to arc through a metallic-coated paper to a black undercoating. This method of printing by its very nature produces a large amount of RFI. So, for whatever the reason, the ZX Printer never was released by Sinclair or Timex in the United States. A few ZX printers made their way into the hands of some American and Canadian ZX81 enthusiasts, but they were never available "over the counter" in the United States.

The quality of the ZX Printer was fair, but certainly not good. However, it was small, easy to use, and offered complete dot-for-dot duplication of a screen character, including all standard graphic characters and special patterns generated by high-resolution graphic programs. Pretty nice for under $100!

### THE NEW TIMEX SINCLAIR PRINTER

When Timex licensed Sinclair computer technology for the United States and Canada, and produced the Timex Sinclair 1000, they made the decision to abandon the ZX Printer and find one that would have the same dot-for-dot definition, but better quality — and would qualify under FCC regulations regarding RFI. They contracted with Alphacom, a California company, to produce their small printer with a special Timex interface and maintain the under-$100 selling price. Thus was born the Timex Sinclair 2040 Printer, with a suggested retail price of $99.95, and now available at thousands of outlets that handle the T/S1000. As an added bonus, the 2040 will also work with the soon-to-be-released T/S1500 and 2000-series computers!

The 2040 is a thermal printer — quiet both physically and electronically, so RFI is within FCC limits. The paper is a very light gray — almost white — and the "printing" is black and sharp. This same type of printing method has become very common in printing calculators and computer printers. No ribbons or ink are used, though special paper is necessary.

This new printer, though considerably larger than the ZX Printer, is still very small as computer printers go. It is 7.75-in. wide, 5.5-in. deep and 2-in. high. It has an additional 1-in. high dome to cover the 82-ft. roll of 4.33-in. wide by 1.9-in. diameter paper that fits in a cavity near the back of the printer. A 6-in. long cable extends from the left-rear of the printer and ends in a "piggyback" connector that allows you to plug the printer onto the

computer and also use additional peripherals — like outboard RAM packs. A separate power-pack, in the form of a wall-plus transformer supplied with the 2040, plugs into the back of the printer to provide its own power source. It weighs about 2 pounds, including paper.

### FEATURES GALORE

The 2040 has all the features of the ZX Printer and more. Like the ZX Printer, it reproduces every character or dot-combination of the computer, with a maximum of 32 characters spaces on a line. Since each character space can contain eight dots on any of the Timex computers, that's 256 dots across. Each character space is also eight dots high. With 22 user-available lines on the display, for a total of 176 dots from the top to the bottom of the user display area. The 2040 will produce every one of those 256 × 176 display dots or "pixels". That's 45,056 on a single display screen! The COPY command on the computer keyboard does just that — it reproduces every screen pixel on the printer. And it does it quietly and fast — two lines of 32 characters in a second! It will also respond to LPRINT and LLIST commands from the keyboard or within a program. COPY can also be used within a program.

> There are only two controls on the 2040 — OFF and ON/ADVANCE

There are only two controls on the 2040 — an ON/ADVANCE button and an OFF button. It's obvious what the buttons do when pressed separately, but when you press the OFF button once while holding down the ON/ADVANCE button, the printer goes into a self-test mode and prints alternate lines of 8s and 1s until you stop it. Loading the paper is easy, and the paper advance is smooth. Connecting the 2040 to the computer is simply a matter of plugging it onto the card-edge at the rear of the computer and plugging in the printer power adaptor. It really couldn't be any simpler! There is no special software "driver" program or interface required; all the necessary electronic translation of printer signals takes place within the printer itself. Somehow it recognizes that it is connected to either a T/S1000, 1500 or 2000 series computer and acts accordingly, even though the ASCII codes coming from the computers are not the same! It will not reproduce the color signals from a T/S2000-series computer — all dots are plain black.

The Timex Sinclair 2040 Personal Printer comes complete with one roll of paper, a power adaptor, instructions and 90-day warranty. It is well protected for shipping in a fitted styrofoam container inside a beautiful black, white, blue, and silver box. What a great gift for a Timex computer owner!

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AD Code TSU3

John Gilbert provides the third instalment in his guide to learning programming

# Simple ways of sorting data

DATA STRUCTURING comprises a series of topics which most beginners like to leave alone, unless they are students majoring in computer science. The reason is that the subject can become complicated. For that reason I have decided to deal with just two areas of a vast subject.

This month I explain how to sort files of data and next month how to search through the sorted data and how best to display it on the television screen or printer.

There is only one data structure in the BASIC language and that is the array. An array is a series or table of data items which are grouped under one name. They are indexed using a number. Most professional data processing programs are not written in BASIC but in machine code, because of speed restrictions. Also, using data compression techniques in machine code you can enter much more data into the machine than would normally be possible.

Databases written in BASIC do not often use arrays as it is better to use long strings of characters into which the data is put, or concatenated, as it is entered. In that way a user does not have to specify the length of a file or how many data items can be entered as a maximum.

Arrays occupy more memory space and their length has to be fixed before data entry but sorting and searching is easier to understand by using one- or two-dimensional arrays, as we can deal with data one element at a time.

The file creation and data entry routines of the database being constructed in this series are shown in figure one.

Line 110 of last month's listing

**Figure 1**

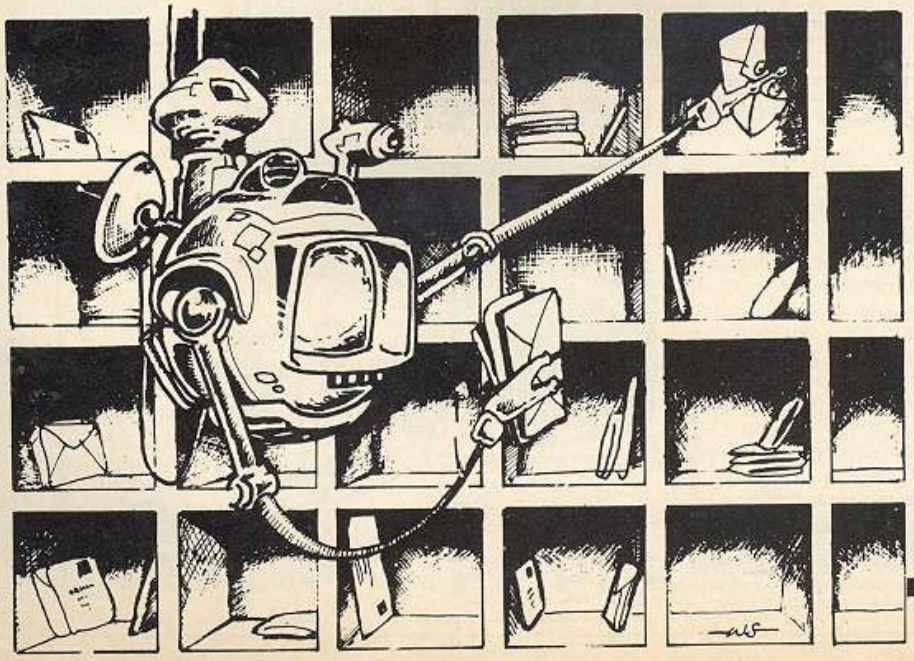
```
  10 REM ADDITIONAL POINTER ARRAY "C" VARIABLE "P" POINTS
     TO NEXT AVAILABLE SPACE FOR DATA.
 100 DIM B$(100,20)
 110 DIM C(3)
 120 LET P=1
5000 REM CREATE FILE
6010 CLS
6012 PRINT AT 5,0; "HOW MANY DATA ITEMS IN FILE? "
6014 INPUT D$
6020 LET D= VAL D$
6030 CLS
6032 PRINT AT 5,2;"WHAT IS THE MAXIMUM"; AT 7,2;
     "LENGTH OF EACH ITEM "
6034 INPUT E$
6036 LET E= VAL E$
6038 IF E > 20 THEN LET E=20
6040 DIM B$(D,E)
6042 LET C(2)=D
6044 LET C(3)=E
6046 CLS
6050 PRINT AT 5,2; "NUMBER OF ITEMS ";
     D; AT 7,2; "LENGTH ";E; " OKAY?"
6060 INPUT F$
6070 IF F$(1)="N" THEN GOTO 6000
6080 RETURN
7000 REM DATA ENTRY ROUTINE
7010 IF P>D THEN GOTO 7070
7020 PRINT AT 5,0; "ENTER ITEM "
7022 INPUT X$
7025 IF B$="STOP" THEN RETURN
7030 IF LEN B$ > LEN B$(P)
     THEN GOTO 7060
7040 LET B$(P)=X$
7042 LET P=P+1
7050 GOTO L
7060 PRINT AT 10,0; "ENTRY TOO LONG.
     RE-ENTER."
7065 GOTO 10
7070 PRINT AT 10,0;"CURRENT FILE FULL "
7075 GOTO L
7080 RETURN
```

**Figure 2**

```
8000 REM BUBBLE SORT
8010 LET P1=1
8012 LET P2=2
8014 LET SC=0
8020 IF B$(P1,1) > B$(P2,1) THEN GOSUB 8090
8030 LET P1=P2
8032 LET P2=P2 + 1
8040 IF SC=0 AND P2 > P THEN GOTO 8120
8050 IF P2 > P THEN GOTO 8020
8060 IF SC=0 AND P2 > P THEN GOTO 90
8070 GOTO 8030
8080 LET SC=SC+1
8090 LET H$=B$(P1)
8092 LET B$(P1)=B$(P2)
8094 LET B$(P2)=H$
8100 RETURN
8110 CLS
8112 PRINT "SORTED"
8115 PAUSE 200
8120 RETURN
```

**Figure 3**

```
8000 REM SHELL SORT MODIFICATIONS
8012 LET P2= INT(P/2)
8030 IF P2>P THEN RETURN
8032 - THIS LINE IS DELETED
```



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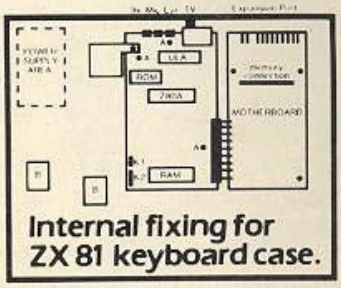
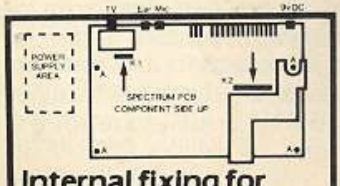
This is supplied with spectrum legends, and a slightly different base for fitting the spectrum inside, again all the connectors are at the rear of the case and there is plenty of room for the power supply (and other add-ons). Should you want to change, we can supply both the Spectrum legends and details of updating your case which will enable modification from the ZX 81 to spectrum. PLEASE specify on your order whether you require the ZX 81 or spectrum case.




**Internal fixing for ZX 81 keyboard case.**

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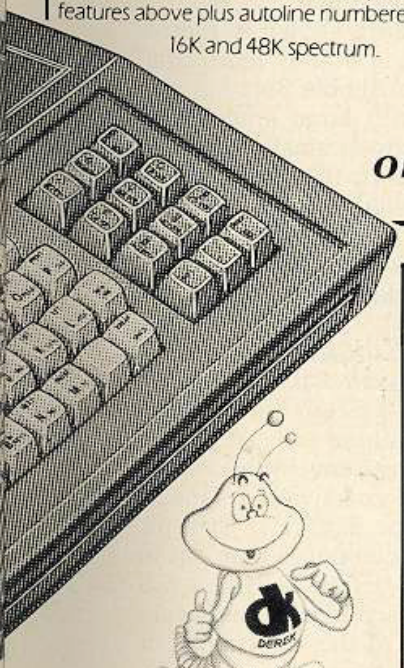
# ZX 80~81 Spectrum HARDWARE

## SPECTRUM/81 TOOLKIT

This is the toolkit which won acclaim in the feature in the August 1982 issue (pages 29 and 30) of Sinclair User. "It is the most impressive program, fast in execution with clear and full instructions...it stands out from the rest of the field." The ZXED is a powerful editor for use on the expanded ZX81. It is intended for use by the serious BASIC programmer and offers several useful and time saving features most helpful during all stages of program development. The facilities provided are as follows: ALTER, BYTES, COPY, DELETE, FIND, HELP, INSERT, KEEP, MOVE, RENUMBER AND VERIFY. The Spectrum Toolkit contains most of the features above plus autoline numberer and append, and will run in the 16K and 48K spectrum.



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The above illustration shows the casing for the 16K or massive 64K.

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**pansion *$135.00***

rmation on the 16K also applies to the 64K Memory Expansion, but the he 64K giving nearly FOUR times the memory. This advanced model has nory. In addition, the block from 8K to 16K can be switched out to enable dd-ons. The graphics ROM is to be used in this area. Position in Memory: lock From 8192-16384 is switchable.

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trum to 48K of user Ram. The Spectrum memory expansion is simple to fit. nside the case, and then only requires plugging in. Full fitting instructions he only tool you will need is a screwdriver and just two minutes of your quires no electronic skills. Position in memory from 32768 to 65536. (The pgrade to 48K).

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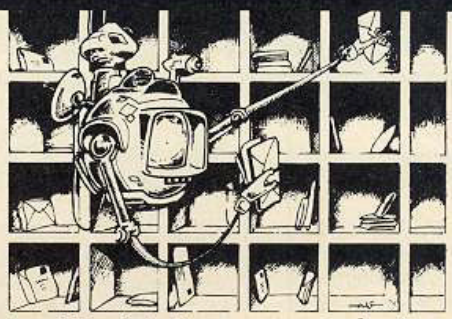


has been added to contain another array, C. That array will hold the number of the next available space in a file, the maximum number of data items it is possible to store, and the maximum length, in characters, of a data item.

In the file creation routine the user can define the file length and word length but if they are over the maximum bounds, the computer will set them automatically to 100 and 20 respectively. The data entry routine is not yet included on the menu. It is best to put it in the menu routine at line 750 and set it to the Entry Subroutine at line 7000. The menu display at line 1030 will have to be changed so that "ENTER DATA ITEM" is displayed under "CREATE FILE".

When those alterations have been made, the enter routine at line 7000 can be added to the listing.

Figures two and three show program listings for two techniques which can be adapted for use with database. They are two of many. The study of data sorting techniques has interested academics for a long time and some sophisticated algorithms, step-by-step methods of solving problems, have evolved.

Figure two shows the Bubble or Shuttle Sort. It is fairly simple to use but very slow when dealing with large amounts of data. It is called the Bubble Sort because the data is sorted into a list in ascending order with items in the incorrect order 'bubbling' up to the top. The data items are sorted using a keyword, usually the first word of or number in the item. The Bubble Sort will take the first character in an item and compare it to the first character of the next data item.

You may like to change the routine to look at the first three or four letters of a word. The routine can take anything up to three minutes to sort 50 items of data. If you are not concerned with the time element, the routine is easy to program and use.

In the program, line 8010 defines the pointers being used in the routine. Pointer p1 will show the first item on the list and p2 the one beneath it. The variable sc will contain the number of swaps made in one pass. When that is zero at the end of a pass, the sort is concluded.

Line 8020 will send control to the swap routine if the first data item is greater than the second. Line 8030 advances the pointers and line 8040 will return to the menu if the sort is complete. Line 8070 returns control to make another pass of the data.

The swap routine starts at line 8080, and 8090 will swap the data items which are in the incorrect order. Line 8100 returns control to the main sort routine and line 8110 informs the user that the sort is complete. The routine can be improved by adding a line to make the computer display a message, such as 'SORTING', to inform the user a sort is taking place.

The Basic listing in figure two can be used as a base for the other sorting technique known as the Shell Sort and the line numbers which have been modified are shown in figure three.

The Shell Sort, shown in figures three and 4b, is slightly more complex than the Bubble Sort but will run faster with large amounts of data. If a relatively small amount of data, for instance 100 items, is to be used, the Bubble Sort will do the job just as quickly as the Shell Sort.

For the Shell Sort the data file is split approximately into two halves. The pointer p1 is, as with the Bubble Sort, set to the first data item in the file. The pointer p2 is set to the item halfway through the data file.

The item pointed to by p1 is compared to all the items in the second half of the file and swaps are made, as before, if p1 is greater than p2. When p1 has compared item one to all of the last half of the file it will point to the second item and again compare that to the second half of the file.

The sort is finished when either p1 or p2 arrives at the last item of the file and the sc swap counter variable is 0. That shows that no swaps were made in the last pass through the data and the information in the file is in the correct order.

Both structures created by the sort routines from figures two and three are illustrated in figure four. As I have said previously, they are just two of many routines and it is possible to create several other sorts using the two basic structures outlined.

Next month we will encounter a technique of searching data quickly using a BASIC routine. I will also explain the best ways in which to display data on the screen, either as individual items or specific lists.

Figure 4

**BUBBLE SORT STRUCTURE (BEFORE SORT)**

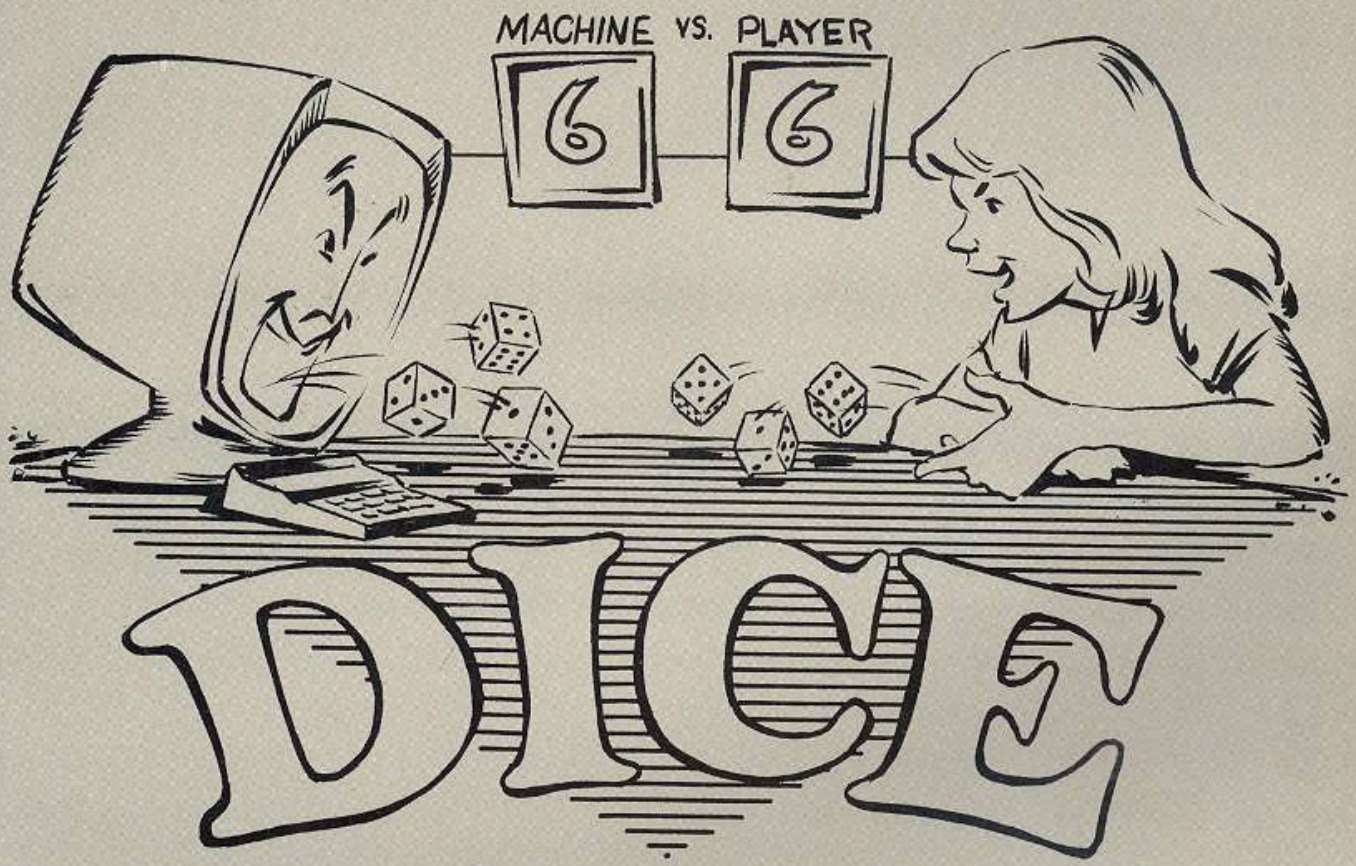
| ITEM NUMBER | DATA ELEMENT |
|---|---|
| 1 | SINCLAIR |
| 2 | MICRODRIVE |
| 3 | PRINTER |
| . | . |
| . | . |
| . | . |

Figure 4b

**SHELL SORT STRUCTURE (BEFORE SORT)**

| ITEM NUMBER | DATA ELEMENT | |
|---|---|---|
| 1 | USER | FIRST ITEM IN FILE |
| 2 | HELPLINE | |
| 3 | MODEM | SECOND ITEM IN FILE |
| . | . | |
| . | . | |
| . | . | |

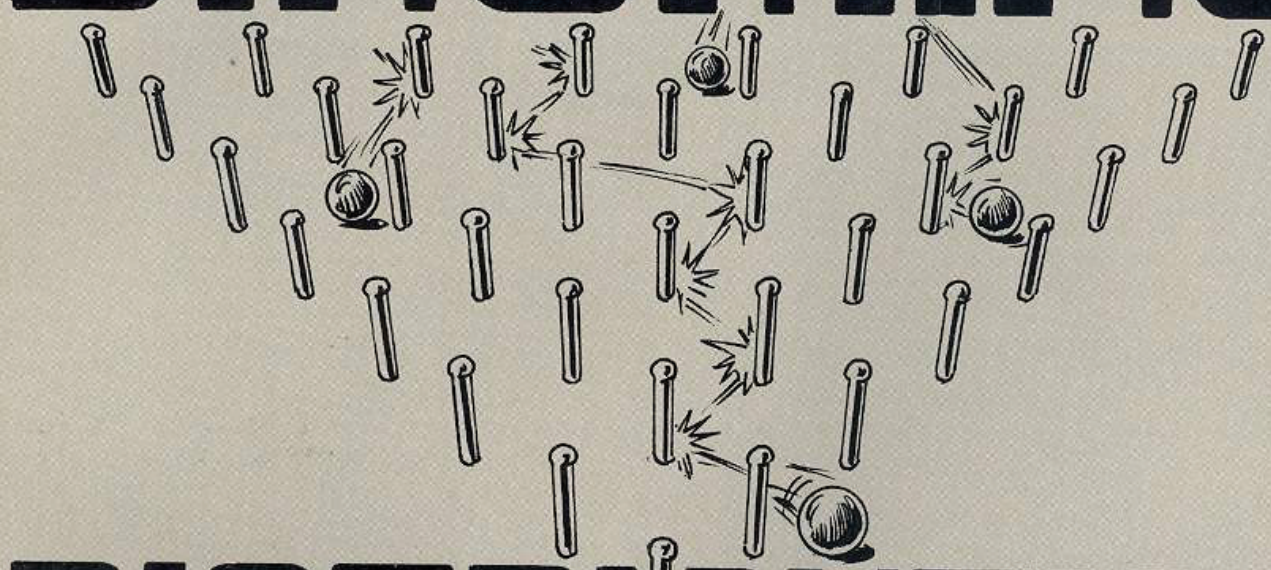
# PROGRAM PRINTOUT




DICE is another 2K game that takes advantage of the random number generating feature of the T/S1000,ZX81. One die appears on the screen with its number constantly and randomly changing. You stop your "roll" by pressing ENTER. That number is your score. You get ten rolls and a ten-roll total score. Then the machine takes its ten rolls. The higher score wins. Since it only uses 2K of memory, this dice routine can be used on any board game you create. (T/S1000,ZX81 2K)

```
 10 LET M=0
 11 LET Y=0
 20 PRINT AT 0,2; "HIGHEST SCORE IN 10 ROLLS WINS";
    AT 2,5; " YOU          ME "
 25 FOR I=1 TO 10
 30 PRINT AT 3,6;M;AT 3,19;Y;AT 16,11;"YOUR ROLL."
 35 GOSUB 180
 40 LET M=M+D
 45 PRINT AT 3,6;M;AT 16,10;" MY ROLL.      "
 50 GOSUB (200+10*INT (RND*6))
 55 LET Y=Y+D
 60 NEXT I
100 STOP
180 PRINT AT 18,0;"PRESS ENTER TO STOP THE DICE."
185 PRINT AT 9,12; " DICE "; AT 10,12;"       ";
    AT 11,12; "       "; AT 12,12;"       "
190 GOSUB (200+10* INT (RND*6))
192 IF INKEY$="" THEN GOTO 190
199 RETURN
200 PRINT AT 10,13;" . ";AT 11,13;"   "
202 LET D=1
205 RETURN
210 PRINT AT 10,13; " . ";AT 11,13; " . "
212 LET D=2
215 RETURN
220 PRINT AT 10,13;".. "; AT 11,13;" . "
222 LET D=3
225 RETURN
230 PRINT AT 10,13;".. "; AT 11,13;".. "
232 LET D=4
235 RETURN
240 PRINT AT 10,13;"..."; AT 11,13;".. "
242 LET D=5
245 RETURN
250 PRINT AT 10,13; "..."; AT 11,13; "..."
252 LET D=6
255 RETURN
```

# BINOMIAL DISTRIBUTION



BINOMIAL DISTRIBUTION might be the first of a new style of program. P R Scott, who submitted it, believes that there are many fundamental scientific principles which could profitably be illustrated on Timex Sinclair machines.

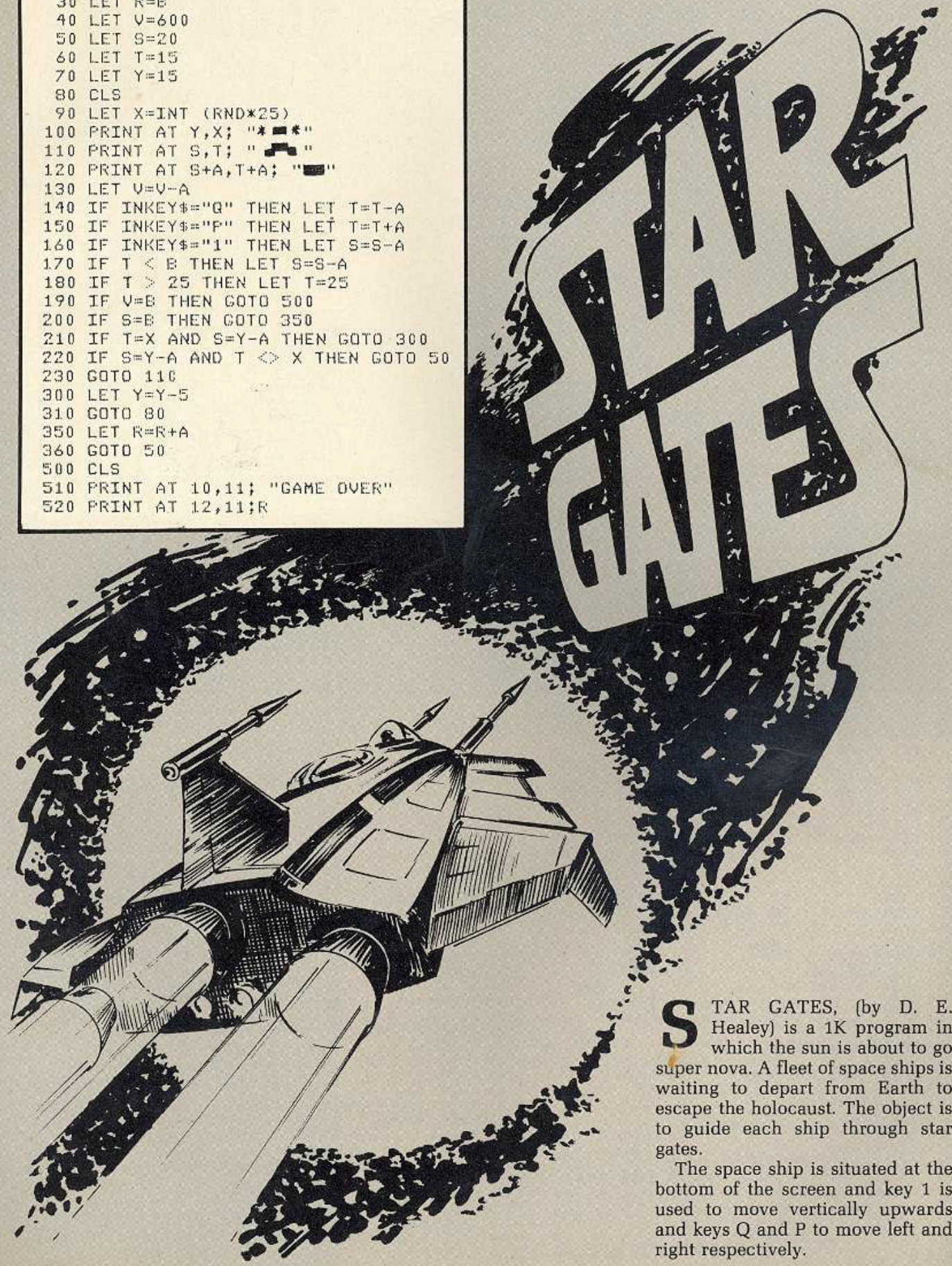
This program for the 16K T/S1000,ZX81 serves to illustrate the principle of binomial distribution. The display shows a ball falling through a triangular matrix of pegs. When the ball hits one of the pegs it rebounds to the left or right, entirely at random.

Its final position is recorded and a further ball produced. The distribution of final positions is the binomial distribution, familiar to most mathematics seniors. You may not know that this characteristic pattern is also of importance in spectral intensities and polymer conformations.

An excellent program, likely to prove of immediate use to teachers and students of mathematics. Graphics notes: 120 — Minus, Four spaces, minus and so on.

```
 10 DIM A(7)
 20 FOR X=1 TO 7
 30 LET A(X)=0
 40 NEXT X
 50 PRINT AT 0,5;"BINOMIAL DISTRIBUTION"
 60 PRINT AT 5,15; "■"
 70 PRINT AT 7,14; "■■"
 80 PRINT AT 9,13; "■■■"
 90 PRINT AT 11,12; "■■■■"
100 PRINT AT 13,11; "■■■■■"
110 PRINT AT 15,10; "■■■■■■"
120 PRINT AT 17,9; "-   -   -   -"
130 PRINT AT 18,11; "-   -   -"
200 PRINT AT 3,15; "O"
210 LET X=15
220 LET Y=3
230 LET XP=X
240 GOSUB 400
250 IF Y=16 THEN GOTO 490
260 LET R=RND
270 IF R < 0.5 THEN LET X=X+1
280 IF R >= 0.5 THEN LET X=X-1
290 GOSUB 400
300 GOTO 230
400 PRINT AT Y,XP; " "
410 LET Y=Y+1
420 PRINT AT Y,X; "O"
430 RETURN
490 PRINT AT 16,X; " "
500 LET Z=(X-7)/2
510 LET A(Z)=A(Z)+1
520 LET P=17
530 IF Z/2=INT (Z/2) THEN LET P=18
540 LET Q=X
550 IF A(Z) >= 10 THEN LET Q=Q-1
560 PRINT AT P,Q; A(Z)
570 IF A(Z)=50 THEN INPUT Z$
580 GOTO 200
```

```
 10 LET A=PI/PI
 20 LET B=PI-PI
 30 LET R=B
 40 LET V=600
 50 LET S=20
 60 LET T=15
 70 LET Y=15
 80 CLS
 90 LET X=INT (RND*25)
100 PRINT AT Y,X; "*▬*"
110 PRINT AT S,T; " ▟▙ "
120 PRINT AT S+A,T+A; "▀▀"
130 LET V=V-A
140 IF INKEY$="Q" THEN LET T=T-A
150 IF INKEY$="P" THEN LET T=T+A
160 IF INKEY$="1" THEN LET S=S-A
170 IF T < B THEN LET S=S-A
180 IF T > 25 THEN LET T=25
190 IF V=B THEN GOTO 500
200 IF S=B THEN GOTO 350
210 IF T=X AND S=Y-A THEN GOTO 300
220 IF S=Y-A AND T <> X THEN GOTO 50
230 GOTO 110
300 LET Y=Y-5
310 GOTO 80
350 LET R=R+A
360 GOTO 50
500 CLS
510 PRINT AT 10,11; "GAME OVER"
520 PRINT AT 12,11;R
```




STAR GATES, (by D. E. Healey) is a 1K program in which the sun is about to go super nova. A fleet of space ships is waiting to depart from Earth to escape the holocaust. The object is to guide each ship through star gates.

The space ship is situated at the bottom of the screen and key 1 is used to move vertically upwards and keys Q and P to move left and right respectively.

# SQUASHED

SQUASHED is an intriguing version of the Break Out game for an expanded T/S1000,ZX81. Imagine a squash court full of milk bottles and a ball made of solid steel. Your job is to break the bottles by moving the bat with keys S and Z.

A running score is kept and the game ends when you destroy all the targets or lose your allocated three balls.

```
 20 REM (C) PER GRONBORG, 1982
 30 REM RESET HI-SCORE BY ENTERING "POKE 16514,0"
 40 LET BALLS=3
 45 LET HI=PEEK 16514
 50 LET BT=9
 55 LET BB=11
 75 LET Y1=SGN (RND-0.5)
 80 LET K=0
 85 LET B=0
 90 LET P=PEEK 16396 + 256 * PEEK 16397 + 1
100 FAST
105 CLS
110 FOR T=0 TO 30
120 PRINT AT 0,T;"■"
130 PRINT AT 20,T;"■"
140 IF T < 20 THEN PRINT AT T,0; "■"
150 NEXT T
160 FOR T=2 TO 18 STEP 2
170 FOR I=1 TO 21 STEP 2
180 PRINT AT T,I;"▮"
190 NEXT I
200 NEXT T
210 FOR T=BT TO BB
220 PRINT AT T,31;"■"
230 NEXT T
240 PRINT AT 21,0; "SCORE:0   HI-SCORE:";HI
245 SLOW
250 FOR T=1 TO BALLS
260 LET X=30
265 LET Y=9
270 LET X1=-1
290 PRINT AT 21,24;"BALLS:";T
300 IF (INKEY$ <> "Z") + (BB=19) THEN GOTO 350
310 PRINT AT BT,31;" "
320 LET BB=BB+1
330 LET BT=BT+1
340 PRINT AT BB,31;"■"
350 IF (INKEY$ <> "S") + (BT=1) THEN GOTO 400
360 PRINT AT BB,31;" "
370 LET BB=BB-1
380 LET BT=BT-1
390 PRINT AT BT,31;"■"
405 IF X=1 THEN LET X1=1
410 LET X=X+X1
415 IF (Y=19)+(Y=1) THEN LET Y1=Y1*(-1)
420 LET Y=Y+Y1
425 LET B1=B
430 LET B=P + 33*Y + X
440 IF PEEK B <> 133 THEN GOTO 500
450 LET K=K+1
460 LET X1=X1*-1
470 PRINT AT 21,6;K
500 POKE B,CODE "0"
505 POKE B1,0
510 IF X=1 THEN LET X1=X1*-1
520 GOTO 600 - (X=30)*70
530 GOTO 1000 - (Y <= BB) * (Y >= BT) * 460
540 LET X1=-1
550 IF NOT (Y1>0) * (Y=BT) + (Y1<0) * (Y=BB) THEN GOTO 570
560 LET Y1=0
565 GOTO 580
570 IF Y1=0 THEN LET Y1=Y1 + (Y=BB) - (Y=BT)
998 GOTO 300
1000 PRINT AT Y,X;" "
1010 NEXT T
1020 PAUSE 200
1100 IF HI >= K THEN GOTO 1200
1110 POKE 16514,K
1120 SCROLL
1130 SCROLL
1140 PRINT "CONGRATULATIONS. NEW HI-SCORE"
1200 SCROLL
1210 SCROLL
1220 PRINT "DO YOU WANT TO PLAY AGAIN (Y/N)?"
1230 PAUSE 5E4
1240 IF INKEY$="Y" THEN RUN
1250 CLS
```

SHARP
SHOOTER

AN ESPECIALLY pleasing display is the strong point of the **Sharp Shooter** program from Paul Naylor.

You are the black-hatted villain confronting a posse of lily-livered bounty hunters. An inverted O represents the deputy badges on their trembling chests. You are armed with a Colt ten-shooter (what?) which you fire with the P key. When the gun is fired the outlaw falls into a very effective crouching position.

Maneuvre the cowpoke up with key 1 and down with A (T/S1000,ZX81).

```
  1 LET N=PI/PI
  2 LET D=VAL "29"
  3 LET A=5
  4 LET H=SIN PI
  5 LET S=H
  6 LET T=INT (RND * VAL "17") + N
  7 LET M=INT (RND * INT PI)
  8 IF M=N AND T>N THEN LET T=T-N
  9 IF M=VAL "2" AND T<VAL "18" THEN LET T=T+N
 10 CLS
 20 PRINT AT T,SIN PI; "0";AT A,D; "▄▄";AT A+N,D+N;
    "█";AT A+VAL "2",D;"▄█";AT A+INT PI,D;"▀▄";
    AT A+VAL "4",D;"▟▟"
 30 IF INKEY$ <> "P" THEN GOTO VAL "120"
 40 PRINT AT A+N,D-N; "▀";AT A+VAL "2",D; "▀▄";
    AT A+INT PI,D; "▄█"; AT A+VAL "4",D-N; "▟▙"
 50 FOR F=VAL "26" TO SIN PI STEP -N
 60 PRINT AT A+N,F;". "
 70 NEXT F
 80 LET S=S+N
 90 IF A+N=T THEN LET H=H+N
100 IF S=VAL "10" THEN GOTO VAL "150"
110 IF A+N=T THEN GOTO VAL "6"
120 IF INKEY$="1" AND A > SIN PI THEN LET A=A-N
130 IF INKEY$="A" AND A < VAL "17" THEN LET A=A+N
140 GOTO VAL "7"
150 PRINT AT A+N,SIN PI;" HITS ";H
```

# Kingdom

FIVE-YEAR PLANS, monetarism, the green revolution, laissez faire and the dictatorship of the people — you can try them all.

**Kingdom** gives you a rural realm to regulate and five years in which to increase your personal wealth and protect your people against flood, famine and the depredations of the ruthless local banditry.

You are first given instructions for the game and asked to input your name, age and sex. Depending on the information you supply, you will be dubbed king, queen, prince or princess and then asked to decide how best to divide your available workforce in the season ahead. Consider the crops, or your subjects will starve. Bear the bandits in mind or your minions are murdered. Delay on the dykes and they will drown.

It is reasonably difficult. Our 1,000 subjects were reduced to single figures after the first year.

Any number can play and you have five years in which to justify

your kingship and to amass as much money as possible by the judicious selling of surplus grain.

Good luck, your highness, and thanks to Andrew Johnson, who submitted this excellent listing (T/S1000,ZX81).

```
 1 PRINT AT 3,7;"******************"
 2 PRINT AT 4,7;"*                *"
 3 PRINT AT 5,7;"* K I N G D O M *"
 4 PRINT AT 6,7;"*                *"
 5 PRINT AT 7,7;"******************"
 6 PRINT AT 10,0; "  YOU HAVE TO GOVERN A VILLAGE";
   AT 12,0; "FOR A PERIOD OF FIVE YEARS.YOU"; AT 14,0;
   "MUST TRY TO KEEP ALIVE AS MANY"
 7 PRINT AT 16,0; "PEOPLE AS POSSIBLE,THEY WILL DO";
   AT 18,0; "ONE OF THREE JOBS."; AT 20,0;
   "YOU MUST PROTECT THEM AGAINST.."
 8 PRINT AT 21,5; "TYPE ANY KEY TO CONT."
 9 IF INKEY$="" THEN GOTO 9
10 FOR F=10 TO 21
11 PRINT AT F,0; "                                "
12 NEXT F
13 PRINT AT 10,0; "...(A)=>FLOODS"; AT 11,0;
   "...(B)=>STARVATION"; AT 12,0; "...(C)=>THEIVES";
   AT 14,0; "YOU HAVE TO BE AS RICH AS POSS."; AT 16,0;
   "AT THE END OF THE FIVE YEARS"; AT 18,0;
   "AND THE RICHEST WINS."
14 PRINT AT 21,5; "TYPE ANY KEY TO CONT."
15 IF INKEY$="" THEN GOTO 15
16 FOR F=10 TO 21
17 PRINT AT F,0; "                                "
18 NEXT F
19 PRINT AT 10,0; "HOW MANY PLAYERS?  ";
20 INPUT A
21 PRINT A
22 DIM N$(A,11)
23 DIM U(A)
24 GOSUB 7000
34 PRINT AT 21,5; "TYPE ANY KEY TO START"
35 IF INKEY$="" THEN GOTO 35
36 FOR F=1 TO 22
37 SCROLL
38 NEXT F
39 GOSUB 8000
40 DIM M(A)
41 DIM C(A)
42 DIM Q(A)
43 FOR F=1 TO A
44 LET M(F)=1000
45 LET Q(F)=1000
46 LET C(F)=2500
47 NEXT F
48 DIM D(A)
49 DIM N(A)
50 DIM Z(A)
51 DIM X(A)
52 DIM T(A)
53 FOR F=1 TO A
54 LET Z(F)=0
55 LET X(F)=0
56 LET T(F)=0
57 NEXT F
100 REM start
105 LET S=0
110 LET Y=0
115 LET S=S+1
120 IF S=1 THEN LET Y$="SPRING"
125 IF S=2 THEN LET Y$="SUMMER"
130 IF S=3 THEN LET Y$="AUTUMN"
135 IF S=4 THEN LET Y$="WINTER"
140 IF S=1 THEN LET Y=Y+1
150 IF S=4 THEN LET S=0
170 FOR P=1 TO A
175 LET N(P)=INT (RND*10)
176 LET Q(P)=Q(P)+N(P)
180 PRINT AT 0,9; Y$; " YEAR "; Y
190 IF N$(P)(11) = "M" AND U(P) > 18 THEN PRINT "KING ";
    N$(P)( TO 10)
193 IF N$(P)(11) = "F" AND U(P) <= 18 THEN PRINT
    "PRINCESS "; N$(P)( TO 10)
195 IF N$(P)(11) = "M" AND U(P) <= 18 THEN PRINT
    "PRINCE "; N$(P)( TO 10)
200 IF N$(P)(11) = "F" AND U(P) > 18 THEN PRINT "QUEEN ";
    N$(P)( TO 10)
201 PRINT
202 PRINT N(P); " PEOPLE CAME TO THE VILLAGE."
203 PRINT
210 PRINT TAB 9; "CASUALTIES:"
211 PRINT " STARVED . FLOODS . THIEVES"
212 PRINT TAB 3; X(P); TAB 12; Z(P); TAB 22; T(P)
214 PRINT "**********************************"
220 PRINT TAB 10; "YOU HAVE:"
240 PRINT TAB 15-(((LEN (STR$ M(P)))+2)/2); "$"; M(P); ","
260 PRINT TAB 15-(((LEN (STR$ Q(P)))+8)/2); Q(P);
    " PEOPLE,"
280 PRINT TAB 15-(((LEN (STR$ C(P)))+15)/2);
    "SACKS OF CORN."
290 PRINT "**********************************"
300 PRINT "LABOR  ARRANGEMENT:"
320 PRINT "(A) MENDING THE DYKE ";
330 INPUT A1
335 IF INT A1 <> A1 THEN GOTO 330
340 PRINT A1
360 PRINT "(B) PLANTING CORN "
370 INPUT A2
375 IF INT A2 <> A2 THEN GOTO 370
380 PRINT A2
400 PRINT "(C) DEFENDING THE VILLAGE "
409 INPUT A3
410 IF INT A3 <> A3 THEN GOTO 409
411 PRINT A3
412 IF A1+A2+A3 <= Q(P) THEN GOTO 420
413 PRINT AT 21,5; "TOO MANY PEOPLE"
414 FOR F=1 TO 22
415 IF INT A3 <> A3 THEN GOTO 410
416 NEXT F
417 GOTO 180
420 IF Y$ <> "SPRING" THEN GOTO 430
422 PRINT "HOW MANY SACKS OF CORN ARE TO";
    "    BE PLANTED?  ";
423 INPUT D(P)
424 PRINT D(P)
425 IF D(P) > C(P) THEN GOTO 422
426 LET C(P) = C(P)-D(P)
427 IF D(P)/10 > A2 THEN LET D(P)=A2*10
430 PRINT AT 21,5; "TYPE ANY KEY TO CONT."
440 IF INKEY$="" THEN GOTO 440
```

```
450 FOR F=1 TO 22
460 SCROLL
465 NEXT F
466 FAST
470 PRINT AT 0,0; M$
490 PRINT AT 8,14; "******"; AT 9,14; "*    *"; AT 10,14;
    "* ++ *"; AT 11,14; "*    *"; AT 12,14; "******"
500 PRINT AT 10,27; "T"
501 LET T(P)=0
502 LET Z(P)=0
503 LET X(P)=0
504 SLOW
510 IF A1 < Q(P)/2.2 THEN GOSUB 1000
520 IF A3 < Q(P)/2.2 THEN GOSUB 2000
530 IF D(P) < Q(P)*2 THEN GOSUB 3000
535 LET C(P) = (C(P)/1.2) + D(P)*3
540 IF C(P)+D(P) < Q(P)*2 THEN GOSUB 4000
550 IF C(P)+D(P) > Q(P)*2 THEN GOSUB 5000
560 LET Q(P)=Q(P)*1.2
565 LET Q(P)=INT (Q(P))
575 LET C(P)=INT (C(P))
580 LET M(P)=M(P)*1.09
583 LET M(P)=INT (M(P))
590 FOR F=1 TO 22
600 SCROLL
610 NEXT F
611 IF M(P) < 0 THEN LET M(P)=0
612 IF C(P) < 0 THEN LET C(P)=0
613 IF Q(P) < 0 THEN LET Q(P)=0
620 NEXT P
630 IF Y < 5 THEN GOTO 115
640 PRINT AT 0,0; "NOW FOR THE WINNER....."
644 LET W$=""
645 LET W=0
650 FOR F=1 TO A
660 PRINT N$(F)( TO 10); " WITH $"; M(F); ","
2020 LET K=INT (RND *10) + 5
2025 IF K*6 > Q(P) THEN LET K=INT (Q(P)/6)
2030 FOR F=27 TO 16 STEP -1
2040 PRINT AT 10,F; "T "
2050 NEXT F
2060 FOR F=1 TO K
2070 PRINT AT 10,16; "(graphic 4)"
2080 PRINT AT 10,16; "(graphic 1)"
2090 PRINT AT 10,16; "(graphic 2)"
2100 PRINT AT 10,16; "(graphic 3)"
2110 NEXT F
2120 FOR F=16 TO 27
2130 PRINT AT 10,F; " T"
2140 NEXT F
2150 LET Q(P) = Q(P)-K*6
2151 LET T(P) = K*6
2160 LET C(P) = C(P)-K*25
2170 LET M(P) = M(P)-K*15
2180 RETURN
3000 REM STAR
3010 LET K = ABS (D(P)-(Q(P)*2))
3015 IF K > Q(P) THEN LET K=Q(P)
3020 LET Q(P) = Q(P)-(INT (K))
3035 LET X(P)=K
3040 RETURN
```

```
4000 REM BUY
4010 LET K=INT (RND*5)+15
4020 FOR F=1 TO 22
4030 SCROLL
4040 NEXT F
4050 PRINT AT 0,0; "YOU HAVEN'T GOT ENOUGH CORN  TO FEED ";
     "YOUR VILLAGE-YOU MUST BUY  SOME..."
4060 PRINT
4070 PRINT "CURRENT BUYING RATE = ";K
4080 PRINT
4090 PRINT "YOU HAVE $"; M(P)
4100 PRINT
4110 PRINT "THE MOST YOU CAN HAVE ARE "; INT (M(P)/K)
4120 PRINT "SACKS"
4140 PRINT "HOW MANY DO YOU WANT TO BUY?";
4150 INPUT I
4160 IF I > (M(P)/K) THEN GOTO 4140
4170 PRINT I
4180 PRINT
4190 PRINT "THAT WILL COST $"; I*K
4200 LET M(P) = M(P)-(K*I)
4210 LET C(P) = C(P)+1
4220 RETURN
5000 REM SELL
5010 FOR F=1 TO 22
5020 SCROLL
5030 NEXT F
5040 PRINT AT 0,0; "YOU HAVE A SURPLUS OF CORN,DO   YOU";
     "WANT TO SELL ANY, IF SO      SPECIFY THE AMOUNT."
5050 INPUT A$
5060 IF A$(1)="N" THEN RETURN
5070 LET K=VAL A$
5071 IF K <= C(P) THEN GOTO 5080
5072 PRINT
5073 PRINT "YOU ONLY HAVE "; INT (C(P)); " SACKS."
5074 IF INKEY$="" THEN GOTO 5074
5075 GOTO 5000
5080 LET J = INT (RND*5)+5
5090 PRINT K; " SACKS OF CORN,AT"
5100 PRINT "$";J; " A SACK,WILL MAKE "
5110 PRINT "$"; K*J
5120 LET M(P) = M(P)+K*J
5130 LET C(P) = C(P)-K
5140 RETURN
7000 FOR F=1 TO A
7010 CLS
7020 PRINT "PLAYER ";F
7030 PRINT
7040 PRINT "YOUR NAME PLEASE:   "
7050 INPUT N$(F)
7051 PRINT N$(F)
7052 PRINT
7060 PRINT "YOUR AGE(APROX)? ";
7070 INPUT U(F)
7080 PRINT U(F)
7090 PRINT
7100 PRINT "ARE YOU MALE(M)/FEMALE(F)? ";
7110 INPUT N$(F)(11)
7120 PRINT N$(F)(11)
7130 PRINT
7140 PRINT "O.K.? ";
7150 INPUT H$
7160 PRINT H$
7170 IF H$="NO" OR H$="N" THEN GOTO 7010
7180 NEXT F
7190 RETURN
8000 FAST
8005 LET M$=""
8010 FOR F=1 TO 22
8020 LET M$ = M$ + "(three graphic As;inverse SPACE;
     twenty two SPACEs;six /s)"
8030 NEXT F
8040 SLOW
8050 RETURN
9000 SAVE "KINGDOM"
9010 RUN
```

My little ZX81 was not doing well in its competition with our Atari 2600 VCS. Even though I had a great Space Invaders and a real fine Road Race, it just could not hold the attention of my eight-year-old for very long. I decided to try a different approach.

I felt the only advantage that the ZX81 possessed was its ability to evaluate changing inputs and its ability to respond to the user in terms he could appreciate. Also, I noticed that the kids would sit at the Atari for hours with their eyes glued to the score. Why not use these features and teach more than just "eye-hand" coordination?

When I taught elementary school, I found that students love games and even enjoy boring, rote material when it is presented as a game. The spelling bee is a good example of the game-type teaching method. It will work when everything else fails.

My first opportunity came when my third grader announced that he was learning his multiplication tables and had to have my help in studying. I wasted no time in preparing a little program to help. The result was better than I expected.

Listing 1 shows a program that responds to the learner and gives him immediate feedback on his answers. Its greatest advantage is that *it keeps score.* I found that if a friend is working with him, my son works for long periods just to make sure his score is the highest when the practice set ends. The "game" ends after every ten problems. Each correct answer racks up ten points and an incorrect answer scores zero.

The program lets the learner select his own table and generates a random problem between 0 and 9. The program is set up for single place but could be expanded to two or three place multiplication by changing the 10 in line 110 to either 100 or 1000 respectively.

The unexpanded T/S1000,ZX81 will handle this program, but it can easily be expanded on a unit using the 16K RAM pack. I've found that students appreciate comments on their scores. A list of computer responses based on the score could easily be incorporated between lines 230 and 250.

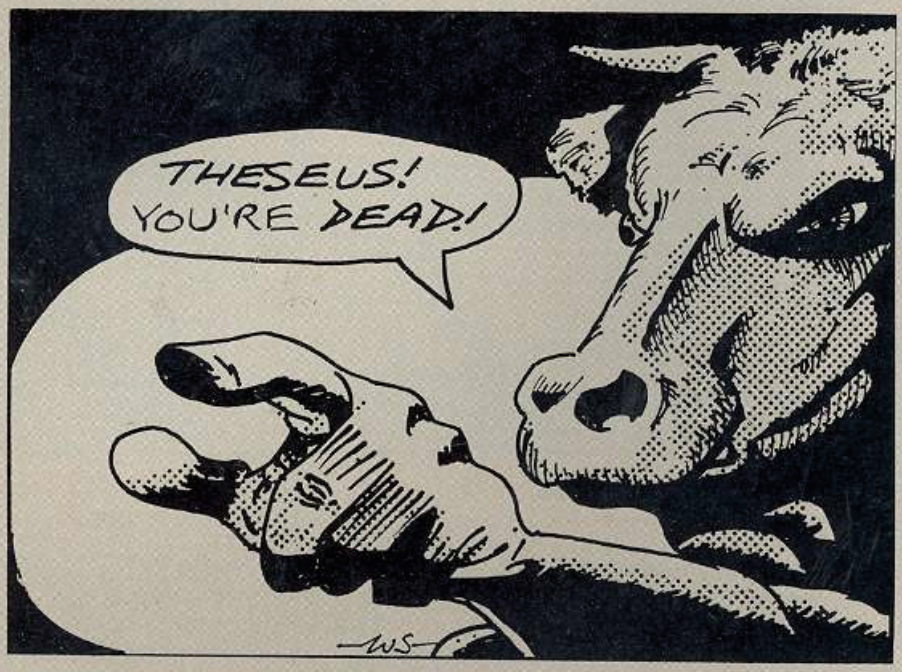
Use of the ZX81 is gaining rapidly at our house.

***— Jim Stephens***

*Listing 1. Flash Card Program*
**(T/S1000,ZX81 2K)**

```
 10 REM — MULTIPLICATION
    TABLES — AGES 6-9
 20 PRINT "HELLO — WHAT IS
    YOUR NAME?"
 30 INPUT N$
 40 LET T = 0
 50 PRINT "YOUR TOTAL IS "; T
 60 PRINT "WHAT TABLE WOULD
    YOU LIKE,"; N$; "?"
 70 LET S = 0
 80 LET N = 0
 90 INPUT X
100 CLS
110 LET Y = INT (RND*10)
120 PRINT X; "X"; Y
130 INPUT Z
140 LET N = N + 1
150 PRINT Z;
160 IF Z = Y*X THEN PRINT
    "CORRECT"
170 IF Z = Y*X THEN LET S=S+10
180 IF Z=Y*Y THEN PRINT " NO,
    THE ANSWER IS ";Y*X
190 IF N = 10 THEN GOTO 210
200 GOTO 110
210 CLS
220 PRINT "YOUR SCORE FOR
    THIS TABLE "; N$ ; "IS "; S
230 LET T = T + S
240 PRINT "YOUR TOTAL IS ";T;"
    DO YOU WANT TO CONTINUE?
    Y-N"
250 INPUT A$
260 IF A$ = "N" THEN GOTO 280
270 GOTO 60
280 PRINT "ENTER RUN TO START
    AGAIN"
290 STOP
```

# MINOTAUR




MINOTAUR is an excellent maze game for the expanded T/S1000,ZX81. the display is a random-generated maze with yourself as an "O". Your task is to reach the exit at bottom right by using the four cursor keys. Your main problem is to avoid the hungry Minotaur which is able to home in on your position.

We were impressed by the intelligence shown by the beast, which is able to check its position against yours, without slowing the program. The routine used would obviously be useful in composing a Pacman-style program.

Occasionally the random maze proves to be blocked, so a quick visual check is a good idea. Sent by Kevin Tutte. (T/S1000,ZX81 16K)

```
 20 FAST
 30 DIM M$(21,31)
 40 M=1 TO 19 STEP 2
 50 LET M$(M)="(thirty one inverse SPACEs)"
 60 FOR N=1 TO 3
 70 LET M$(M,INT (RND*28)+2)=" "
 80 NEXT N
 90 LET M$(M+1,1)=" "
100 LET M$(M+1,31)=" "
110 NEXT M
120 LET M$(1)="(thirty one inverse SPACEs)"
130 LET M$(21)=M$(1)
140 FOR M=4 TO 18
150 LET R=INT (RND*28)+2
160 IF M$(M-1,R) <> " " AND M$(M+1,R) <> " "
    THEN LET M$(M,R)="(inverse SPACE)"
170 NEXT M
180 LET M$(20,30)="(graphic A)"
200 LET X=2
210 LET Y=2
220 LET CX=2
230 LET CY=20
240 LET D=-1
400 FOR N=1 TO 21
410 PRINT AT N,1;M$(N)
420 NEXT N
430 SLOW
500 PRINT AT Y,X;" "
510 LET X=X+(INKEY$="8" AND M$(Y,X+1) <> "(inverse SPACE)")
    -(INKEY$="5" AND M$(Y,X-1) <> "(inverse SPACE)")
520 LET Y=Y+(INKEY$="6" AND M$(Y+1,X) <> "(inverse SPACE)")
    -(INKEY$="7" and M$(Y-1,M) <> "(inverse SPACE)")
530 PRINT AT Y,X;"O"
540 IF X=30 AND Y=20 THEN GOTO 600
550 PRINT AT CY,CX;" "
560 GOSUB (1000*(1+(CY=Y) + 2* (M$(CY+1,CX) <>
    "(inverse SPACE)" AND (Y>CY)) + 3* (M$(CY-1,CX) <>
    "(inverse SPACE)" AND (Y<CY))))
570 PRINT AT CY,CX;"inverse QUOTATION MARK)"
580 GOTO 500
600 PRINT AT 0,1; "WELL DONE YOU ESCAPED";
610 STOP
700 PRINT AT 0,1;"BAD LUCK YOU HAVE BEEN EATEN"
710 STOP
1000 IF M$(CY,CX+D) = "(inverse SPACE)" THEN LET D=-D
1020 LET CX=CX-D
1025 IF CX=31 THEN LET D=-D
1030 RETURN
2000 LET D=(CX<X) - (CX>X)
2010 IF CX=X THEN GOTO 700
2020 IF M$(CY,(CX-1) TO (CX+1))="(inverse SPACE;SPACE;
    inverse SPACE)" THEN LET D=0
2030 GOTO 1000
3000 LET CY=CY+1
3010 IF CX <> X THEN LET D=(CX<X) - (CX>X)
3020 RETURN
4000 LET CY=CY-1
4010 IF CX <> X THEN LET D=(CX<X) - (CX>X)
4020 RETURN
```

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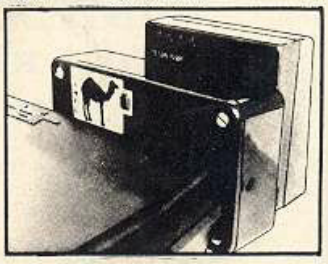

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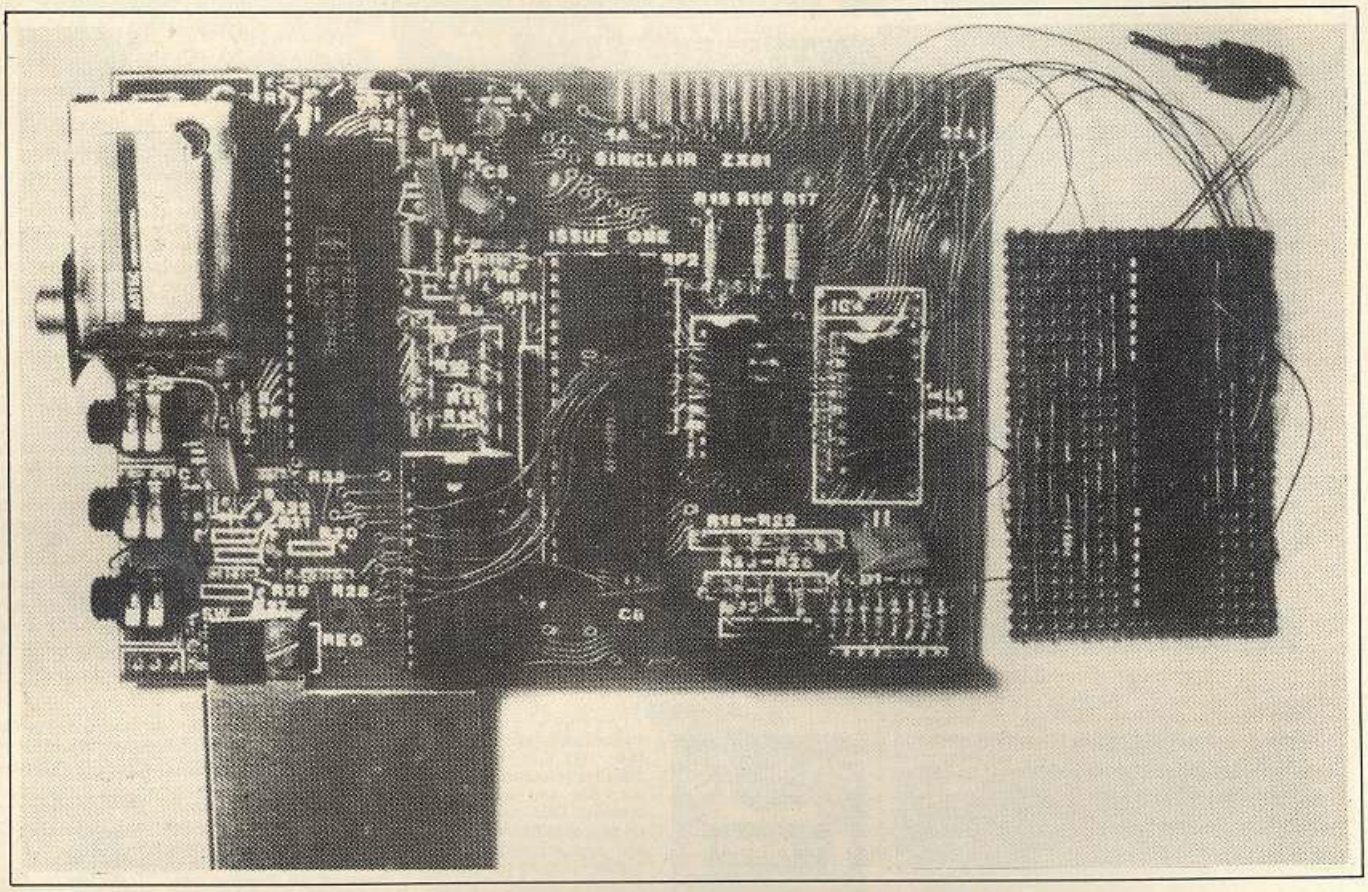


*Figure 1: Graphics generator board attached to the ZX81*

# Circuit training helps to build good characters

THE CHARACTER table — dot patterns — are located in the T/S1000,ZX81 ROM from 1E00 (hex), to 1FFF (hex), i.e., 7680 to 8191 decimal. Each character requires eight bytes — consecutive addresses — to define the dot pattern for the shape required, as shown:

1E00— 7680— 00000000
1E01— 7681— 00000000
1E02— 7682— 00000000
1E03— 7683— 00000000
1E04— 7684— 00000000
1E05— 7685— 00000000
1E06— 7686— 00000000
1E07— 7687— 00000000

Space Character code: 0 decimal, 00 hex.

Good graphics can make all the difference to a program. Dave Looker investigates ways of defining your own illustrations

## PARTS LIST

Components required for this project are:
2 74LSOO Quad NAND gate ICs
1 74LSO8 Quad AND gate IC
1 10K ¼W resistor
1 SPST miniature toggle switch
1 small piece of Veroboard
3½ feet of single-core insulated wire

## GLOSSARY

RAMCS — RAM Chip Select — the line above means active low.
ROMCS — ROM Chip Select — the line above means active low.

If a particular bit is a '1', the corresponding location will be black; if the bit is '0' the location will be white.

The circuit described will enable the character table area of the ROM to be replaced by RAM, which will enable the user to define his own characters by POKEing the required bit patterns into the relevant memory locations.

To accommodate the character dot-pattern table, a minimum of 512 bytes of RAM will be required. It would be possible, of course, to build the necessary RAM ICs into the logic circuit board but that is not really necessary.

When any 16K RAM extension

module is connected to the T/S1000,ZX81, the original RAM is disabled by connecting the internal RAMCS line to +5V. That means that these RAM ICs are available for use as our Characters RAM, with some modifications to the connections, as detailed.

Since the ROM character table is addressed by the Sinclair logic IC during the Display Refresh Interrupt section of the machine cycle, and not by the Z-80 processor, it will be necessary to modify the address connections to the RAM ICs.

Remove the 2114 RAM ICs from their sockets, taking note of the position of the identifying notch in the end of each IC.

Using a pair of tweezers, bend the address pins A0 to A8 — pins 2, 3, 4, 5, 6, 7, 15, 16 and 17 — upwards until they are at right angles to the rest of the pins.

Re-insert the ICs, ensuring that they are orientated correctly, as shown by the identifying notches.

Using the fine insulated single-core wire and a fine-tipped soldering iron, link the corresponding pins of the two ICs together — e.g., pin 2 to pin 2, pin 3 to pin 3.

Using the same fine wire, connect the address pins of the two RAM ICs to the address pins A0 to A8 of the ROM, as follows:

| RAM IC pins | ROM IC pin | Address line |
|---|---|---|
| 2 | 23 | A8 |
| 3 | 1 | A7 |
| 4 | 2 | A6 |
| 17 | 3 | A5 |
| 5 | 4 | A4 |
| 16 | 5 | A3 |
| 6 | 6 | A2 |
| 15 | 7 | A1 |
| 7 | 8 | A0 |

It is not necessary to re-connect the A9 terminals of the RAM ICs (pin 1) to the ROM A9 terminal, since this is a direct connection already.

Having constructed the CHR$ logic circuit on Veroboard as shown in the diagram, proceed with the connection as follows:

The ROMCS line must be located — pin 23B of T/S1000,ZX81 edge connector — and CUT at a convenient point between the edge connector and the ROM.

A small, sharp screwdriver can be used to cut the printed circuit track.

The RAMCS line must be located — pin 2A of edge connector — and cut at a convenient point between the edge connector and internal RAM ICs.

The ROMCS line — pin 23B of edge connector — must be connected to the ROMCS input of the CHR$ logic circuit.

The ROMCS output from the CHR$ logic circuit must be connected to the ROM ROMCS terminal — pin 20 of the ROM IC.

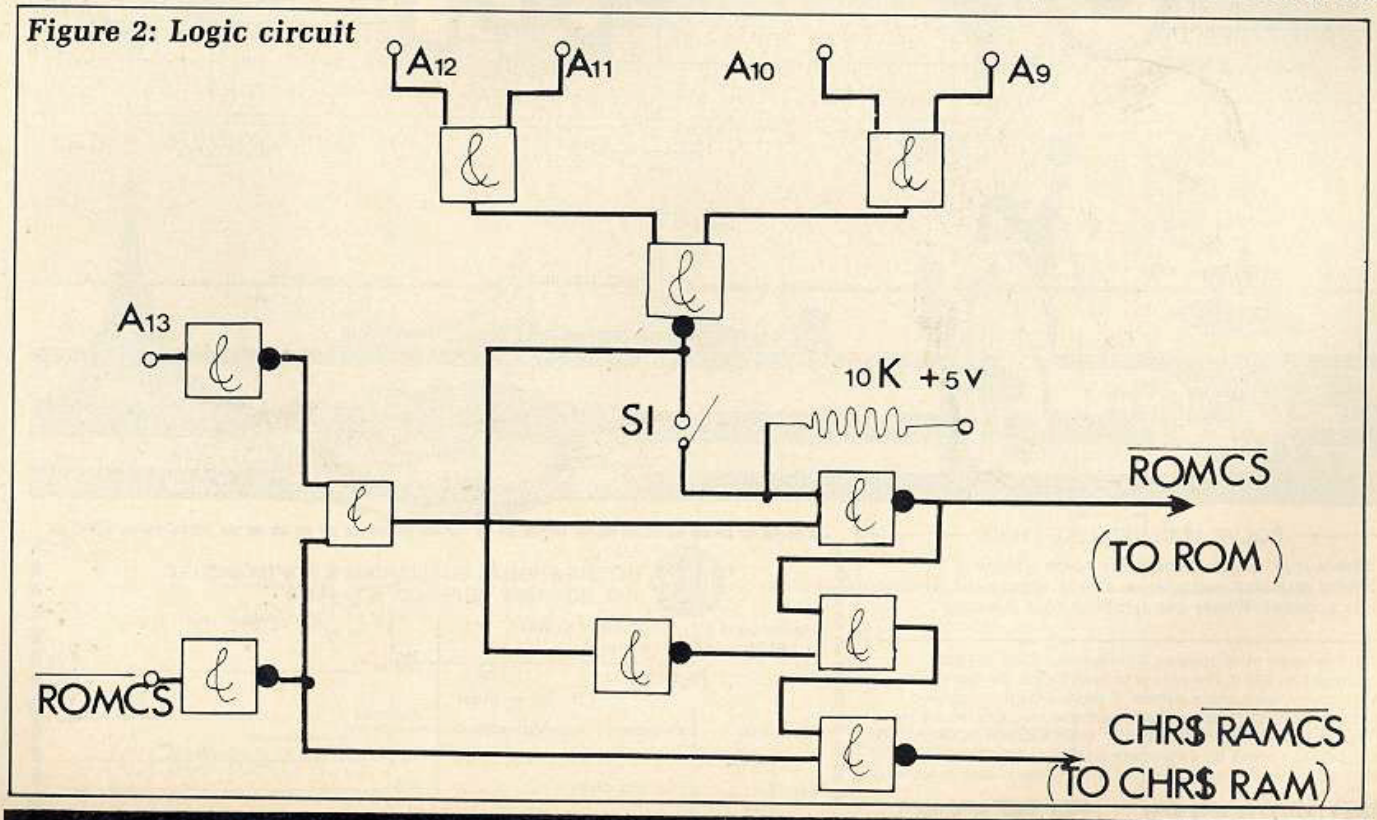
The CHR$ RAMCS output from the CHR$ logic circuit must be connected to the internal RAM RAMCS terminals — pin 8 of either RAM IC.

The address lines A9, A10, A11, A12 and A13 must be connected to the CHR$ logic circuit as shown in the diagram. See edge connector diagram for location of address lines.

The +5V and 0V connections to the CHR$ logic circuit must be connected to pins 1B and 4B of the edge connector respectively.

The switch ($1) connections from the CHR$ logic circuit must be connected to the miniature toggle switch, which can be fitted in the

***Figure 2: Logic circuit***



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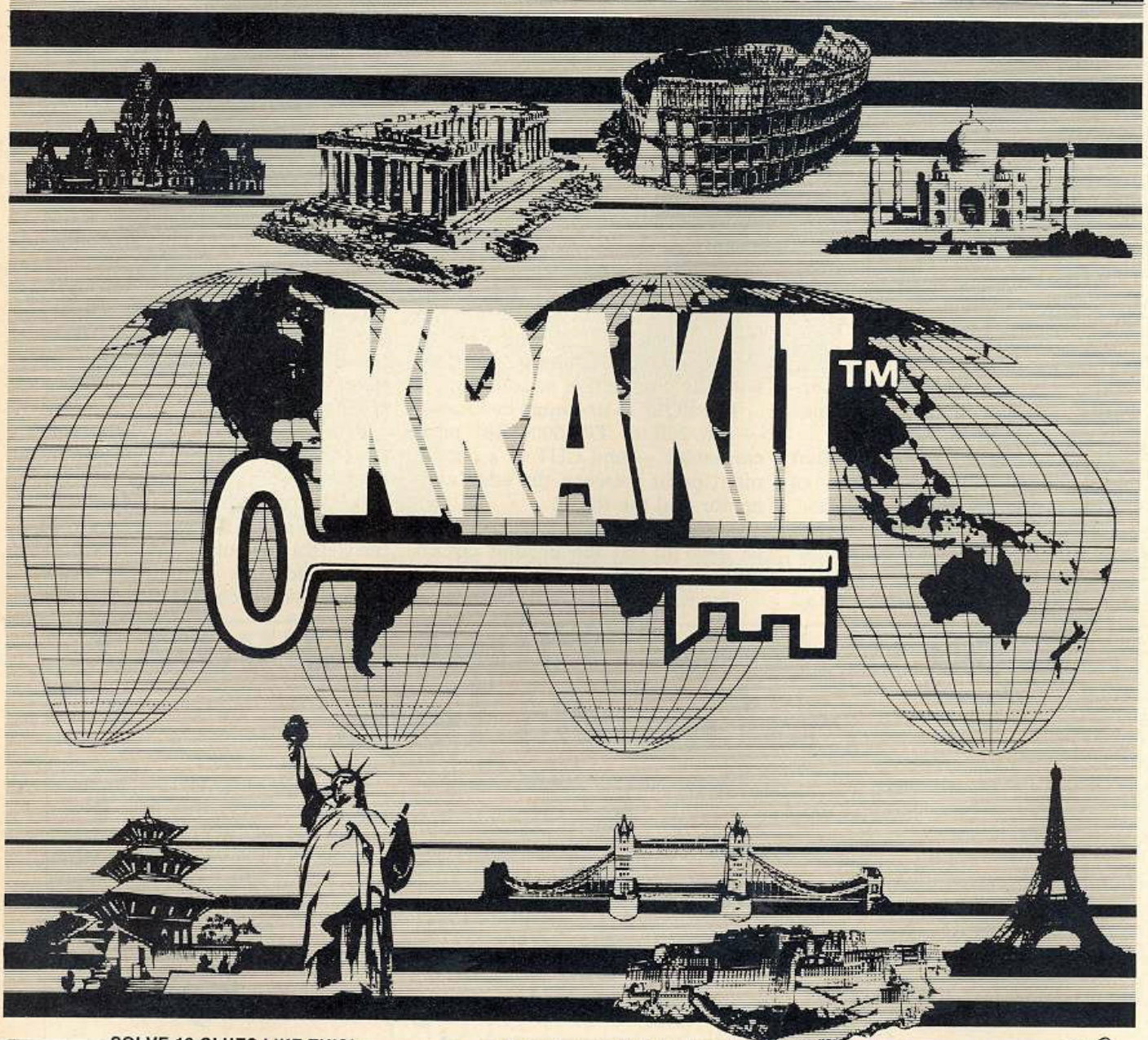


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rear of the T/S1000,ZX81 case, above the circuit board.

All leads should be kept as short as conveniently possible; the CHR$ logic circuit board can be located, with a self-adhesive sticky pad, on the inside of the T/S1000,ZX81 case, immediately above the Z-80 CPU IC.

Take great care with all connections to avoid shorts between circuit tracks; in particular, connections to the pins of ICs should be made as quickly as possible; do not heat the pin for more than two or three seconds at a time, otherwise damage to the IC may occur because of excessive heat.

Check that all connections are correct and that no shorts are present; if everything seems satisfactory you are ready for the initial test of the circuit, as follows:

Make sure that the switch S1 is open, i.e., in the normal position. The purpose of this instruction will become apparent later.

Connect your T/S1000,ZX81 to the TV set and power supply in the usual way; plug in the 16K RAM pack. The T/S1000,ZX81 will no longer work without it.

Switch on the power to the T/S1000,ZX81. If the cursor fails to appear within the usual time, or the display goes into a crash state, switch off immediately and re-check all the connections. It is unlikely that any permanent damage could be caused by incorrect connections; having located and corrected any errors in the wiring, the circuit should then work correctly.

| Binary code | Hex code | Decimal |
|---|---|---|
| 10111101 | BD | 189 |
| 01111110 | 7E | 126 |
| 11011011 | DB | 219 |
| 11111111 | FF | 255 |
| 11100111 | E7 | 231 |
| 01111110 | 7E | 126 |
| 01000010 | 42 | 66 |
| 10000001 | 81 | 129 |

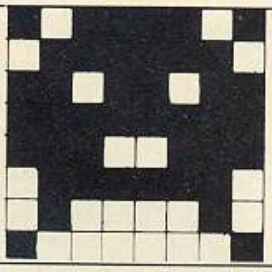


***Figure 3: Internal character representation***

When the cursor appears, enter a few commands or letters to make sure that the keyboard is working correctly, then switch S1 to the CHR$ position — i.e., close S1.

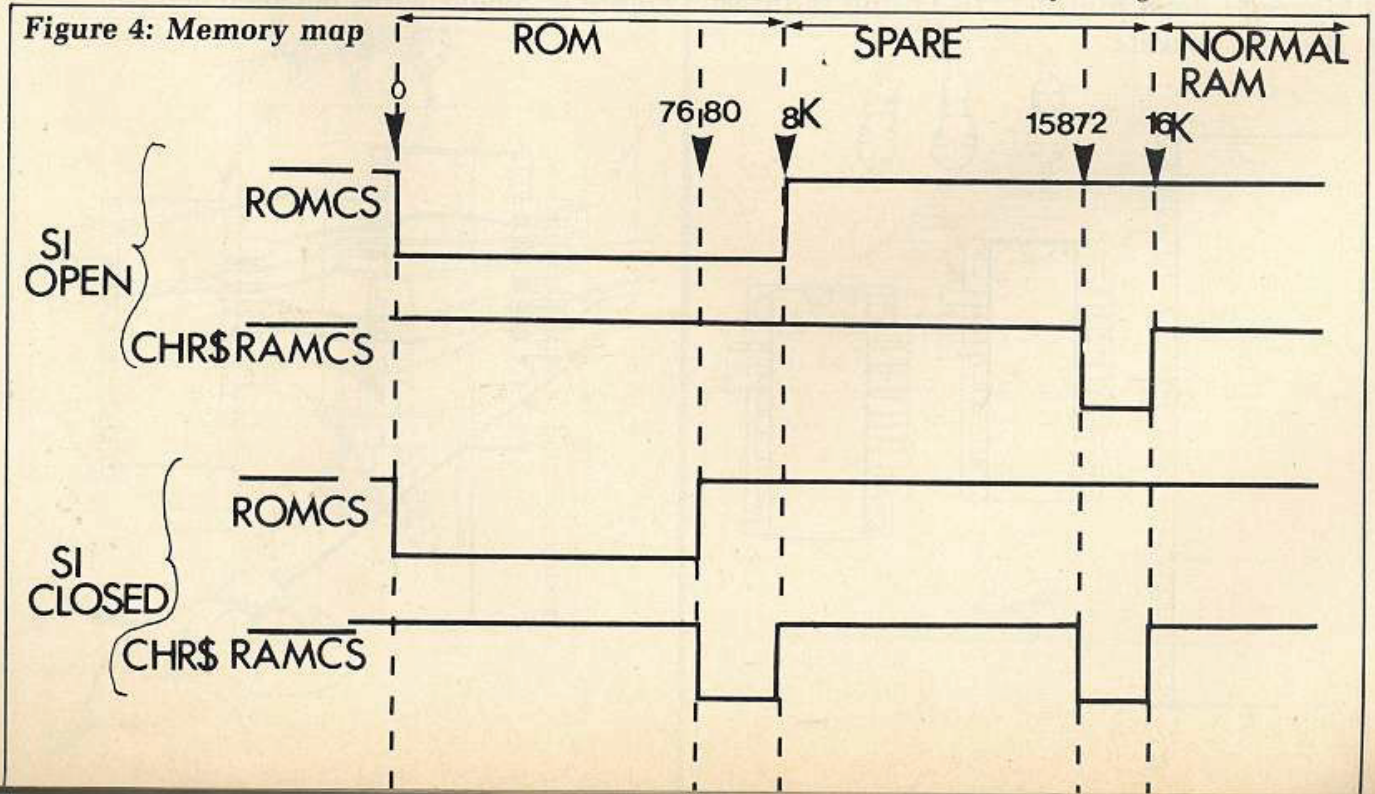
The screen display should change immediately to a random high-resolution pattern, with any characters becoming randomly-shaped blobs.

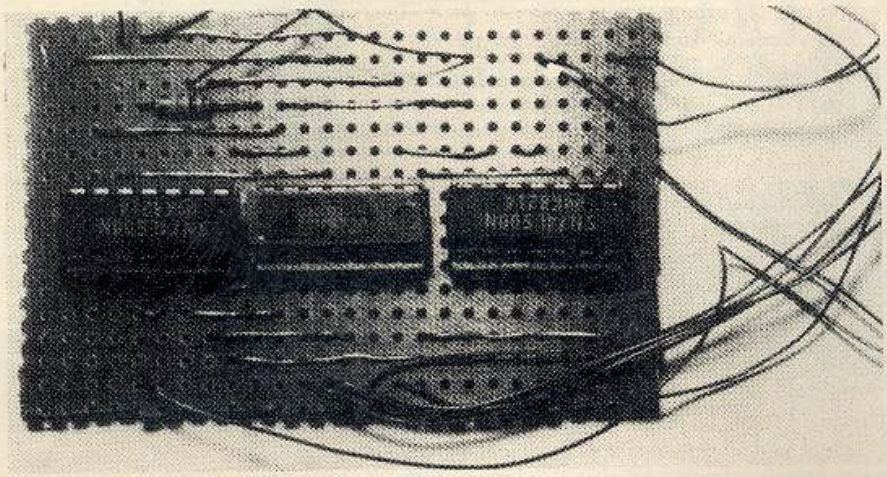
The reason for this effect is that the memory locations in the 2114 static RAM ICs assume random values at power-up; when S1 is closed, the ROM CHR$ table is replaced by the CHR$ RAM which, at present, contains random data, hence the screen display will be random garbage. When S1 is opened, i.e., switched back to the normal position, the display will revert to normal.

Having completed the initial test, re-assemble the T/S1000,ZX81 and proceed to the initialization routine in the next section.

For circuit operation and initialization, with S1 open, the 'ANDED' combination of A9, A10, A11 and A12 will enable $\overline{\text{RAMCS}}$ from 15872 to 16383 (decimal), with $\overline{\text{ROMCS}}$ enabled from 0 to 8191 (0-8K); A13 is used to disable the ROM from 8K to 16K. Thus the computer will operate normally, using the character table in the ROM, which can then be copied into the CHR$ RAM — 15872 to 16383 — either by using a machine-code

***Figure 4: Memory map***





block-shift routine, or by entering a BASIC program (a) of the form:

```
 1 FAST
 5 LET A = 15872
10 FOR M = 7680 TO 8191
20 POKE A, PEEK M
30 LET A = A + 1
40 NEXT M
50 SLOW
```

This program copies all the CHR$ dot patterns in the ROM character table into the CHR$ RAM positioned at 15872 to 16383 on the memory map — 3E00 to 3FFF hex.

Once run, it can be deleted by the NEW command, since NEW will not affect the CHR$ RAM.

With S1 closed, the ROM will be disabled from 7680 to 8191 and the CHR$ RAM will be activated in its place. The CHR$ RAM will also appear at 15872 to 16383 on the memory map, since CHR$ $\overline{\text{RAMCS}}$ will be active-low in this region also.

Having loaded the ROM dot patterns into CHR$ RAM — using program (a) — closing S1 will have no effect on the display but the user can then change any of the characters by POKEing the required values into the relevant memory locations. The character table can be poked in either the 7680 to 8191 section or the 15872 to 16383 section, since the CHR$ RAM appears at both locations when S1 is closed.

The most straightforward way of defining your new character is, first, draw your desired character — preferably on graph paper and write the binary code corresponding to each line, as shown in the example — figure three.

Having worked out the required binary codes, an easy method of conversion to hex code can be employed, using this table:

| Binary | Hex | |
|---|---|---|
| 0000 | 0 | Divide the 8-bit code into two |
| 0001 | 1 | 4r-bit sections and look up |
| 0010 | 2 | at the hex code for each half in |
| 0011 | 3 | the table. The hex equivalent |
| 0100 | 4 | of the 8-bit code is the |
| 0101 | 5 | combination of the hex codes |
| 0110 | 6 | for the two halves: |
| 0111 | 7 | e.g., 1011 1101 |
| 1000 | 8 | B D |
| 1001 | 9 | |
| 1010 | A | So, 1011101 = BD hex |
| 1011 | B | |
| 1100 | C | Using this method, the |
| 1101 | D | codes for each of the eight |
| 1110 | E | bytes which define the |
| 1111 | F | character can be derived as shown for the *Space Invaders* example |

The next step is to decide which

***Figure 5: Bend pins 2-7, 15-17 and re-insert ICs into sockets***

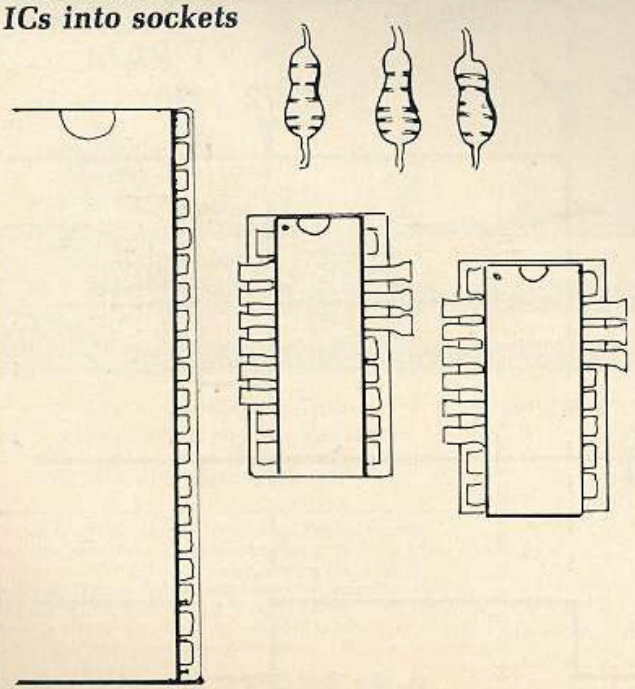
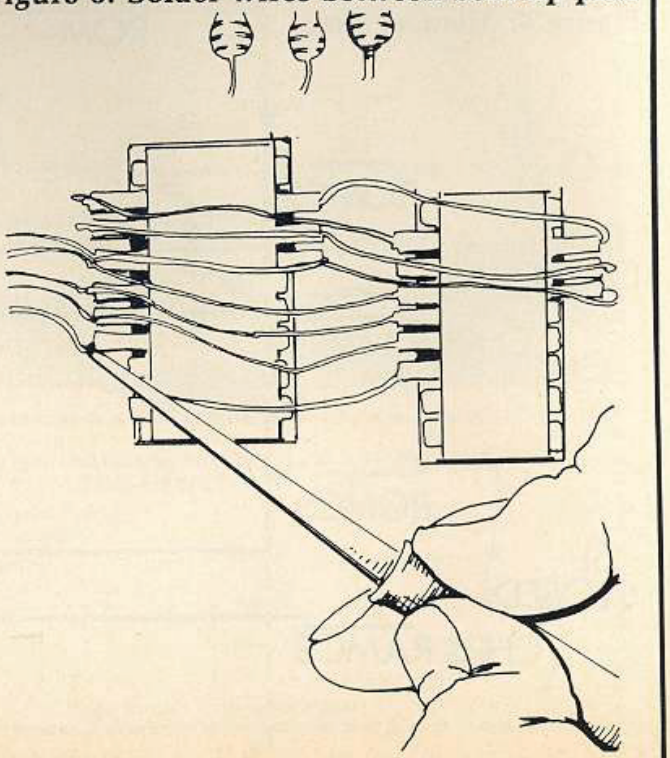


***Figure 6: Solder wires between bent-up pins***



existing character is to be replaced by the new user-defined character. The character code for the character to be re-defined can then be found in appendix A of the T/S1000,ZX81 user manual. That will be a number between 0 and 63, since the inverse characters are generated automatically by the ROM and will always be the inverse of the characters 0 to 63.

The obvious first choices for characters to be re-defined are the graphics characters — codes 1 to 10 — since they will not affect any text content of your program. The following program (b) can be used to redefine any character.

```
10 Print "Input character code (0 to 63)"
20 Input c
30 Print C
40 Print "Input new character Hex Codes"
50 Let M = 15872 + C*8
60 For N = 1 to 8
70 Input H$
80 Poke M, 16 *(code H$ (1)—28) +
(Code H$ (2)—28)
90 Print at 21, 01M;"=";H$
100 Let M = M + 1
110 Scroll
120 Next N
```

For example, input '1' in response to the request for a character code and then input the hex codes for the space invader. To test the result, print the graphics '1' character to the screen in the normal way, then close S1. The graphics '1' will change instantly to the space invader.

The NEW command will not affect your new characters, since the CHR$ RAM is located below 16K (16834), which is the start location of the normal RAM area.

Unfortunately, that also means that the SAVE command will not save your characters either. To save the new characters on to cassette, it will be necessary to find a way of storing the dot-pattern data in the normal program area of RAM.

The easiest way to do so is to store the data in the form of a string — or strings — together with a routine to load the data into the CHR$ RAM before the main program is run. A suitable program (c) would take the following form — see figure nine.

This can be used as a characters initialization routine at the start of any program in which user-defined graphics are to be used, since it incorporates program (a) — lines 13 to 17 — to copy the normal character set into CHR$ RAM before re-defining characters 1 to 10. In fast mode, this routine takes approximately 10 seconds to execute — a small price to pay for the flexibility which is afforded by user-defined graphics.

```
1 Fast
2 Dim A$(10, 16)
3 Let A$(1) = "BD 7E DB FF E7
7E 42 81' (space invader example)
4 Let A$(2) = "Character hex codes"
5 Let A$(3) = "Character hex codes"
6 Let A$(4) = "Character hex codes"
7 Let A$(5) = "Character hex codes"
8 Let A$(6) = "Character hex codes"
9 Let A$(7) = "Character hex codes"
10 Let A$(8) = "Character hex codes"
   Let A$(9) = "Character hex codes"
12 Let A$ (10) = "Character hex codes"
13 Let A = 15872
14 For M = 7680 to 8191
15 Poke A, peek M
16 Let A = A + 1
17 Next M
18 For C = 1 to 10
19 Let M = 15872 + C*8
20 For N = 1 to 15 step 2
21 Let H$ = A$(C,N to N + 1)
22 Poke M, 16 *(code H$ (1)—28) +
(code H$ (2)—28)
23 Let M = M + 1
24 Next N
25 Next C
26 Slow
```

**Figure 7: Connect board to main PCB**

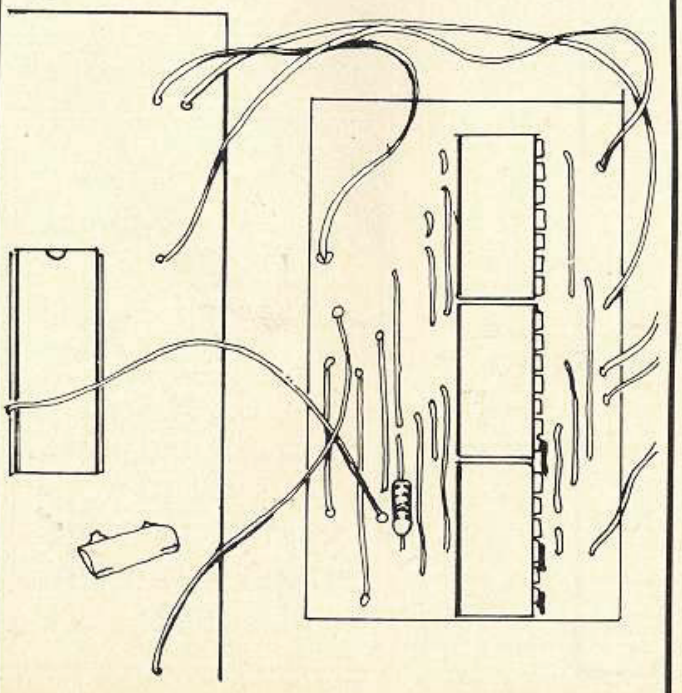
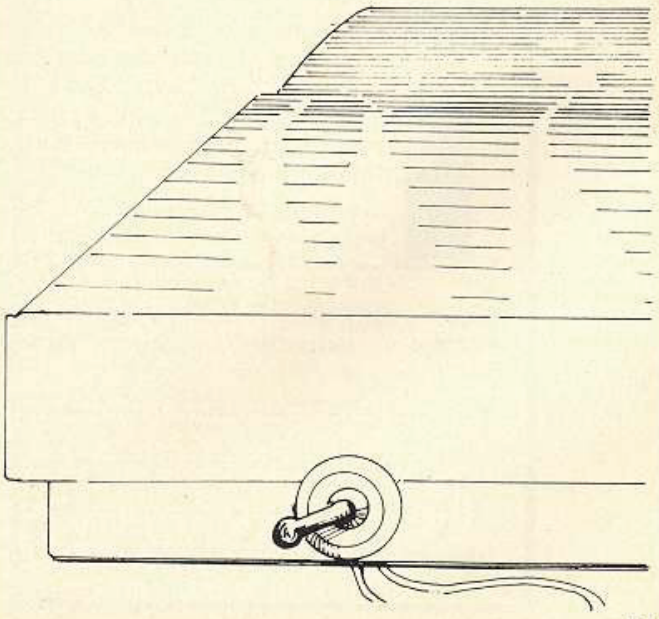


**Figure 8: Attach switch to rear of T/S1000,ZX81 case**



# Letters

*continued from page 6*

## PRICING RAMS

I bought a Sinclair in a kit ($100) and married it to a keyboard. Now I desperately want to expand to 16K. I used to see them advertised for $49 but that was a year ago. Can you assist? Thanks.

**Robert D Evins**
South Gate, California

*We did a quick "thumb-through" of our premier issue and found many companies were advertising 16K, 32K and 48K RAM packs. The prices range from $41.50 to over $150. Like the saying tells us, "You pays your money and you takes your choice."*

## COSMOS REVISITED

I was concerned that the recent review of our program Cosmos (May, *Software*) indicated there is a bug in the program.

There is *no* bug in Cosmos. The problem was related to a poor quality tape reproduction error. In an effort to maintain strict quality control procedures, Mindware is bringing all tape production in-house.

**Rod Haden**
Natick, Massachusetts

*Thanks for the letter. We tried the new samples you sent us, Rod, and they're great! No problems! No bugs! We certainly agree that quality control is essential in the reproduction of cassette programs. After playing Cosmos (we couldn't get our reviewer to stop) we now give it a three-star rating.*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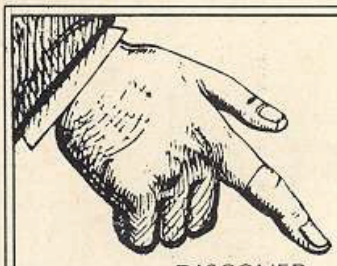

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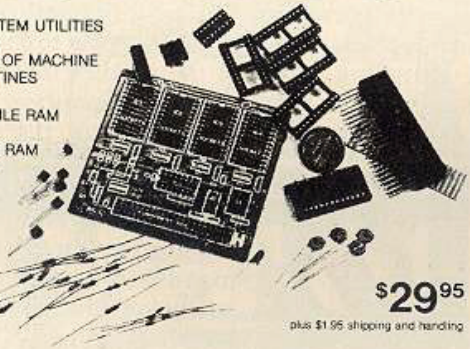

**$29.95**

plus $1.95 shipping and handling

▶ *READ THE REVIEWS:*

What a super product! ...conceived and executed very nicely...and with quality components.
**(SYNTAX QUARTERLY Winter 82)**

8K Nonvolatile memory is a gem! It has so many possible uses...I recommend this board most heartily.
**(OKLAHOMA S.U.G. Newsletter 1/3)**

We found the documentation to be far superior to that (of) most hardware we've received.
**(S.U.N. Newsletter Nov/Dec 82)**

For versatility this is even better than an EPROM...ranks quite high on the list of "must-haves".
**(SYNC Magazine Mar/Apr 83)**

### INTRODUCTION

This memory board is designed to fill the transparent 8K block of memory (from 8 to 16K) in a ZX81-16K system. This area of memory is an ideal place to store, either permanently or temporarily, machine language routines or data which are to be used by the BASIC system.

A sample display routine, a program—merging routine, and procedures for storing utilities on tape are included with the kit.

The use of HM6116LP 2K CMOS RAM memory IC's with their own reserve power supply means that routines stored in the RAM are nonvolatile — the RAM retains its memory even when the ZX81 is switched off or reset. Moreover, being RAM, the routines you store in the memory are easily modified. The lithium cell supplied with the board will maintain sufficient reserve power for almost ten years.

### ASSEMBLY

Complete step-by-step instructions in a 20 page manual make assembly of the board easy. Construction takes between two and three hours. The kit (pictured above) is complete with a silkscreened solder-masked printed circuit board, all capacitors, resistors, transistors, sockets, connectors, integrated circuits, and the lithium cell. The board is supplied with one 2K CMOS 6116LP-3 RAM — it will accomodate three more for a total of 8K.

| | |
|---|---|
| Complete kit with 2K | $29.95 |
| Additional three 6116LP-3 | $16.00 |
| Bare pc board & manual | $13.05 |
| Assembled & tested with 2K | $44.95 |
| Assembled & tested with 8K | $59.95 |
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# British prices fall again

SINCLAIR RESEARCH in Britain maintained its reputation for surprise when, with no more than a brief press statement, it announced a massive cut in the prices of the two versions of the Spectrum.

From a previous price of £175 the cost of the 48K Spectrum was cut to £129.95 ($205), a fall of 25 per cent, and the 16K fell by 20 per cent from £125 to £99.95 ($155). The price of the famous ZX Printer was cut by £20 to £39.95 ($63). At the same time a number of the larger retailers such as W.H. Smith and Boots, reduced the price of the ZX81 by £10 to £39.95 ($63).

The end result is that, in the words of Nigel Searle, the managing director: "For the same price as three years ago we can now offer a much more powerful operating system, 16 times more memory, eight-color high resolution graphics (as opposed to black and white) and a six-times faster tape interface."

It was three years ago that the ZX80 with 1K RAM was launched in Britain at £99.95 ($155).

The surprise, however, was not so much in the size of the reduction as in its timing. In Britain — unlike the United States, where the price war in the home computer market has seen the prices of all machines falling consistently — competition for Sinclair Research is not so great.

There is no immediate threat to the company's dominant share of sales in this country. By the end of this year it expects to have a 60 per cent share of the market.

A decline had been predicted ever since the prices of the T/S2000 were announced at the Las Vegas show. The prices of $199.95 and $149.95 showed that the cost of producing the Spectrum left ample room for price cutting.

As the price was determined by the level of competition and not by production costs, we waited to see when the pressures from other companies in the market would be enough to see a reduction. Most observers did not think that pressure had been built up.

Apart from the Vic 20, most of the opposition is home-grown with names like Oric, Dragon, Lynx, the Jupiter Ace from the designers of the Spectrum, and the BBC Model B commissioned for a television computer series and designed by former colleagues of Clive Sinclair. While selling well, none of these has yet posed a major threat.

While look-a-likes have begun to appear on the American market these have yet to make an appearance on this side of the Atlantic. And Sinclair says that it is not worried by such machines anyway.

For a long time the company has seen the Japanese as being the most likely serious competitors.

As the Sharps and Sanyos have yet to be seen in large numbers it is thought the price cuts were made to dissuade anyone entering the market or proceeding with any plans to develop a competitor. The argument goes that as most investment decisions involved in making a new product are taken long before anything hits the shops, it is better to influence those decisions as early as possible rather than wait until the company is committed to a new product and the battle has to be fought out on the shop shelves.

Some observers feel there is a certain amount of altruism in this. Sinclair is saving the competitors money by making it plain early in the campaign that Sinclair can win the war and so not making it worth their while to make the investment. Others say that the company is just trying to become the IBM of the British home computer market.

The move has thrown the British market into chaos. Eager to gain an advantage, W.H. Smith announced a reduction in its Spectrum prices a week before Sinclair. And the major retailers reduced the ZX81 despite Sinclair not making a similar cut, thus reducing their retail margins to maintain the sales of the smaller machine.

The competition has yet to make a move but there is no doubt everyone is waiting to see how the reduction will affect sales.

Sinclair is confident that it has the production capacity to meet demand. More than 50,000 Spectrums are being produced each month at its two suppliers, Timex in Dundee and Thorn-EMI just outside London. It is intended to increase this level "substantially" and the target of worldwide sales of 400,000 units by the end of 1983 should be beaten easily. And that does not include figures for the sales of the T/S2000.

Meanwhile the Microdrive with its ability to increase greatly the amount of storage capacity is still awaited. When it does go on sale it can be expected to make commercial life even more difficult for the non-Sinclair machines.

*— Nigel Clark*
*in London*

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**16K programs require 16K RAM memory pack.*

## ADVENTURE

**A1. Samurai Warrior** — A game where, as a Samurai warrior, you battle with other Samurai and with bandits to protect villages. Can you become Shogun? (16

**A2. Tyrant of Athens** — Disasters, famines, attacks from land and sea. Can you resist them all and remain Lord of Athens? (16

**A3. Roman Empire** — Send legions to conquer Mediterranean countries — and if you succeed, crown yourself Caesar! (16

**A4. Peloponnesian** — A re-enactment of famous battles between Athens and Spar Try to win allies and influence people befo the final battle! (16

**A5. Warlord** — You'll need swift judgemen to protect your village from marauding bandits and Samurai, your fleet from pirate and your people from slavery. (16

**A6. Escape From Manhatten** — MAY DAY . . . MAY DAY . . . The President's plane has crashed, on an island of convicts! Get there! Get him! Then get out again! (16

**A7. Demon Adventure** — Standard-text adventure game with real-time battles and which relies on complexity rather than difficulty of play. (16

**A8. The Thing** — A graphic adventure gam set in the Antartic. Escape to the helicopter and save your life — if you can. (16

## ARCADE ACTION

**R1. J.D. Arcades** — Three popular m/code games with some novel twists. (1

**R2. Outrider** — Save your mother ship. She being assailed by aliens! (1

**R3. Xaraks** — Get round the maze without

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the guard catching you. And if you want to make things difficult for yourself, there are nine levels of play, all m/code. (16K)

**R4. Avenger** — A classic. Can you win the planet? Destroy oncoming missiles, bombs, and the city below to stake your claim. (16K)

**R5. Protector** — Defend your ship against oncoming missiles. Can you create the highest-ever score? (16K)

**R6. Bomber** — You must land, but not before all alien life forms are neutralized . . . but they want to neutralize you! (16K)

**R7. Alien Rain** — There's an Extra Terrestrial on one side of the screen, and you're on the other. It's raining — bombs! Please try and rescue the Extra-Terrestrial. (16K)

**Program listing continued overleaf!**

# get the ...Now!


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- ☐ *P3. Video Sketch* ..... $14.95

**Games**
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- ☐ *G2. Music Program* .... $9.95

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### BUSINESS

**B1. Word Processor** — Use your TS1000 to familiarise yourself with word processing. If you have a printer, prepare a letter to your friends. (16K)

**B2. The Spread-sheet** — Prepare forecasts, budgets, projections and models. This spread-sheet planner for the TS1000 brings professional computer techniques within everyone's reach. (16K)

**B3. Trawler** — A business-management game set in the North Sea. Can you match the catch of a top trawler captain? (16K)

### CHALLENGE

**C1. Video Map** — Navigate your plane cross-country. Sounds easy? If you go off course . . . (16K)

**C2. Golf** — Play your game of golf in the comfort of your own home! But don't be deceived — you still have to deal with sand, rough, trees, etc. (16K)

**C3. Pilot** — That's you. Can you land your plane safely in the dark? (16K)

### COMPUTING

**P1. Hi-Res Package** — Greatly enhances the graphics facilities of your TS1000, increasing the resolution to 256 x 192. (16K)

**P2. Video Graph** — Despite the name this one doesn't plot graphs! Instead, this fascinating program enables you to create pictures which can be stored, and then merged — like an Identikit. (16K)

**P3. Video Sketch** — Use the full graphics facilities of the TS1000 — draw, type, use the large alphabet and reverse images. (16K)

### GAMES

**G1. Party Tricks** — A range of programs with listings suppied, to give the novice an insight into the TS1000 BASIC. (1K)

**G2. Music Program** — Compose your music on the TS1000. With the aid of an amplifier it can play for you (16K)

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# News

## New 16K computer is compatible with the T/S1000,ZX81

# Timex introduces the 1500

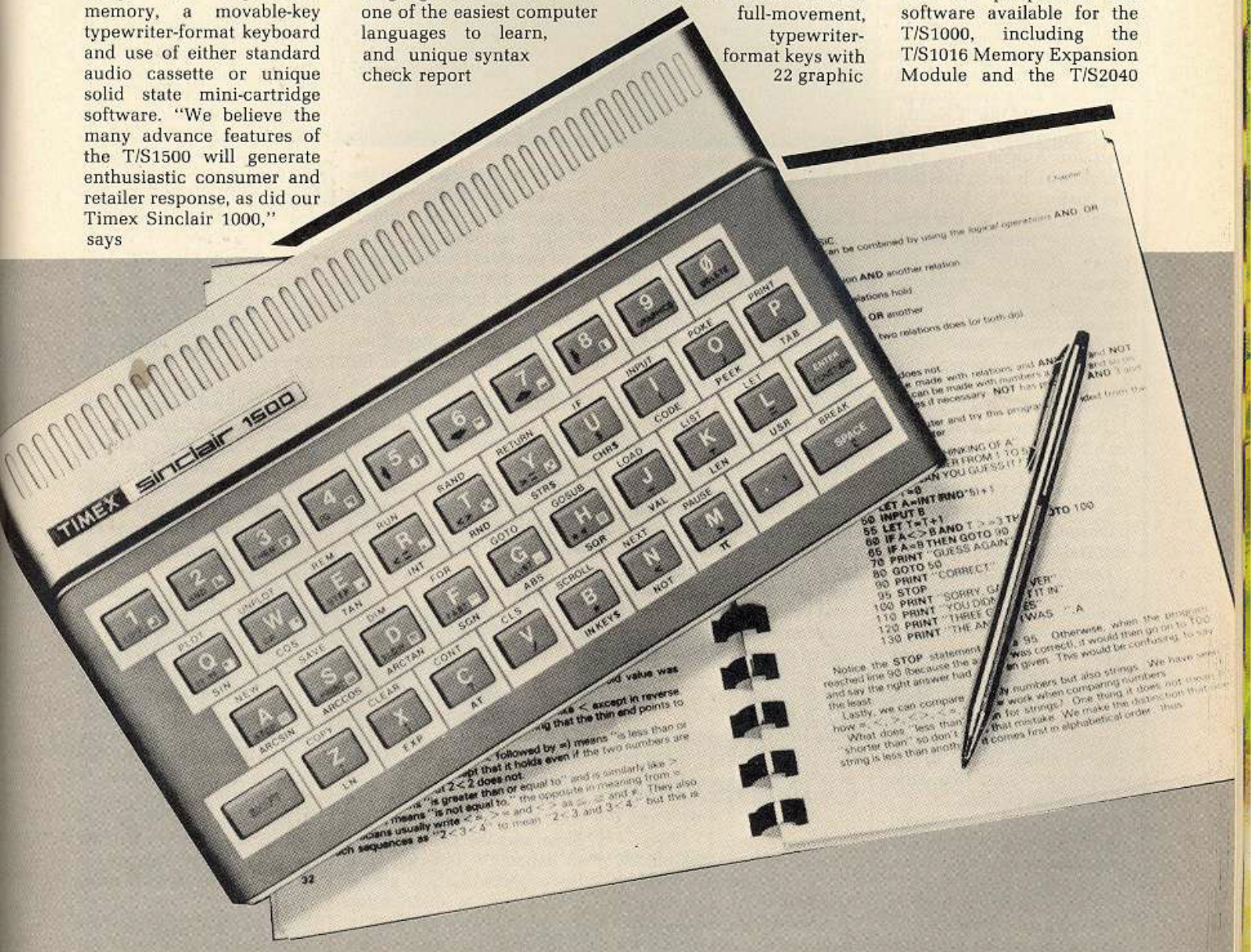
Timex Computer Corporation has introduced the first 16K personal computer with a suggested retail price under $80.

Named the Timex Sinclair 1500, the computer is fully programmable, with black-and-white graphics capability, an expandable memory, a movable-key typewriter-format keyboard and use of either standard audio cassette or unique solid state mini-cartridge software. "We believe the many advance features of the T/S1500 will generate enthusiastic consumer and retailer response, as did our Timex Sinclair 1000," says Daniel Ross, Vice President of Timex Computer Corporation.

The T/S1500 features a 16K byte RAM that can be expanded to 32K with the addition of the optical T/S1016 Memory Expansion Module. The programming language is extended BASIC, one of the easiest computer languages to learn, and unique syntax check report codes allow users to instantly identify and correct programming errors. The graphic display area is controlled by PLOT and UNPLOT commands in addition to the 22 pre-defined graphic characters.

The multi-function keyboard of the T/S1500 has 40 full-movement, typewriter-format keys with 22 graphic characters and 22 special characters. The keyboard also features Timex's unique key-word entry, which enables each key to perform as many as six possible functions, thus reducing a great deal of input typing.

The T/S1500 is compatible with all peripherals and software available for the T/S1000, including the T/S1016 Memory Expansion Module and the T/S2040



# News

Thermal Printer. In addition, all Timex peripheral products are designed to plug directly into the computer an advantage over many other computers which require the purchase of separate expansion boxes before peripheral products can be used.

Timex currently offers an extensive library of more than 100 inexpensive home cassette software packages, all fully compatible with the T/S1500. LOADing and storage of these programs is achieved with most standard audio cassette recorders.

In addition, Timex has developed an instant-load solid state software cartridge for use with the T/S1500. First shipments are scheduled for August. The cartridge, which easily fits into the palm of a hand, is inserted into a low-cost cartridge interface which plugs directly into the computer thus avoiding the need for an outside cassette recorder as an input device. Timex solid state mini-cartridges are expected to have a suggested retail price of $12.95 to $29.95.

Timex software is available on a broad range of subjects. offering Timex computer users ready-to-use programs for home management, business, educational and entertainment use.

Communication with data banks and telecommunication services will be possible with the T/S1500 through the use of a communications interface device, or modem, which Timex will soon introduce. It also plans to introduce special programs which allow users to do shopping and banking through the modem.

The T/S1500 is packaged complete with all power, TV and cassette recorder cables, and a comprehensive, step-by-step instruction manual that features a fundamental course in BASIC programming.

## Also from Timex: a new printer

The new products from Timex Computers are starting to roll. True to their company policy, quality has been the concern of all involved. The new printer, the Timex Sinclair 2040 (reviewed on page 30 of this issue), is a good example of that attitude. This printer reproduces any character on the T/S1000,ZX81 keyboard. And it does so on plain white or blue paper (no electrosensitive paper required).

Whatever you can put on the screen, the 2040 printer can put onto paper. It prints 32 columns wide at two lines per second. Its full graphics capability is based on a dot matrix print mechanism. It's not only quiet, but it also is efficient. The clear print-out can be program controlled to allow you to custom-control the print format. It is completely compatible with the ZX81 and sells for only $99.95. That's a bargain. The Timex 2040 is a fine printer.

## Timex responds

You may have had problems finding a store that stocks all of Timex's computer products. There have been problems replenishing supplies like printer paper or parts for do-it-yourself repair buffs. Timex has solved those problems by opening a special mail order division to handle special requests. Now if you need schematic drawings, printer paper, wire, spare parts, add-on RAM packs, printers or other items, this new Timex division will send you an order form and you can charge your purchases on your MasterCard or Visa. Write to:

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## COMDEX '83

On April 26 to 29, Comdex '83 small computer show was held in Atlanta, Ga. Six hundred computer companies displayed their work for more than 20,000 visitors. The focus was clearly on the personal computer as the computer of the future. Phillip Estridge, an I.B.M. vice president and keynote speaker felt the market for personal computers has just been scratched. "I don't think we've seen more than the tip of the iceberg as far as sales are concerned," he stated. Another computer company spokesperson felt we were at the model-T stage in personal computer development. Everyone at the show believed the small portable computer was the wave of the future.

## Now in Canada

TX Computers Canada (the official name of Timex Computers in Canada) will be launching the T/S1000 in Canada this summer. The official launch date was June 1, which has come and gone and the launch is yet to happen — but that is to be expected when you're setting up a distribution chain for a new product.

According to a TX Canada spokesperson, the corporation hopes to have initial sales of 150,000 units of the basic computer, which will sell for $69.95 Canadian. Then there's the add-ons and the software. Good luck TX, Canada is ready!

## Microdrives for T/S Machines?

Sinclair Research in Britain, the developers of the ZX81 computer which was the prototype for the T/S1000, is close to announcing the launch date of a Micro Drive for the T/S2016 and T/S2048. The working relationship between Sinclair and Timex is such that when the drive comes on line in the British market, the American market is next. Whatever hardware Sinclair Research develops for their computers will automatically be adapted for use with the Timex computer line.

Nigel Searle, managing director of Sinclair Research in the U.K., would not give a definite production date. "We have learned from experience not to give launch dates until we are sure. We cannot say when the Microdrive will be available, "Searle emphasized.

At present, the price of the drives is projected to be about $60 with another $45 for the interface which will allow up to eight drives to be attached to the Spectrum. While the T/S2000 line has not yet been introduced to the North American market, it probably will be by late fall. That means we will not have to wait as long for the Microdrive as the U.K. users did. It might even happen that the Microdrive and the T/S2000 line will come out simultaneously.

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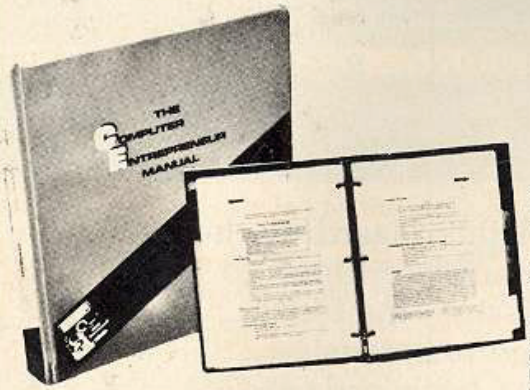


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# 6 KEYBOARDS COMPARED

## Which is the one for you ?

One of the most common complaints regarding the T/S1000,ZX81 is that the keyboard is difficult to use. Because of its compact design, the touch-sensitive keypad is not suited to extensive programming sessions. Add-on keyboards are available for your T/S — but which one should you buy? To help our readers decide, *Timex Sinclair User* asked freelance reviewer M.K. Wilson to test six keyboards and one overlay. "I was surprised," she told us afterwards, "to discover how much they vary in cost, size, design, versatility and ease of assembly and operation." Her report:

OF THE SIX keyboards I tested, only the **Memotech** requires no assembly. Its attractive blue keyboard is cable-connected to a buffered interface which simply plugs into the edge port connector on the back of your T/S1000; peripherals then plug neatly into the edge connector on the interface. The lightweight plastic keys are a bit too close together for comfort and ease in extensive programming, but respond well to a light touch. As you must remove your hands to press the ENTER and space keys, it is not really possible to touch-type on this keyboard. An interesting and unique feature of the Memotech is that you can use it and the T/S keypads simultaneously, which would be useful in a student-teacher session when only one computer is available or when playing games that require two players. The Memotech sits apart from the computer and comes com-

plete with its own aluminum case.

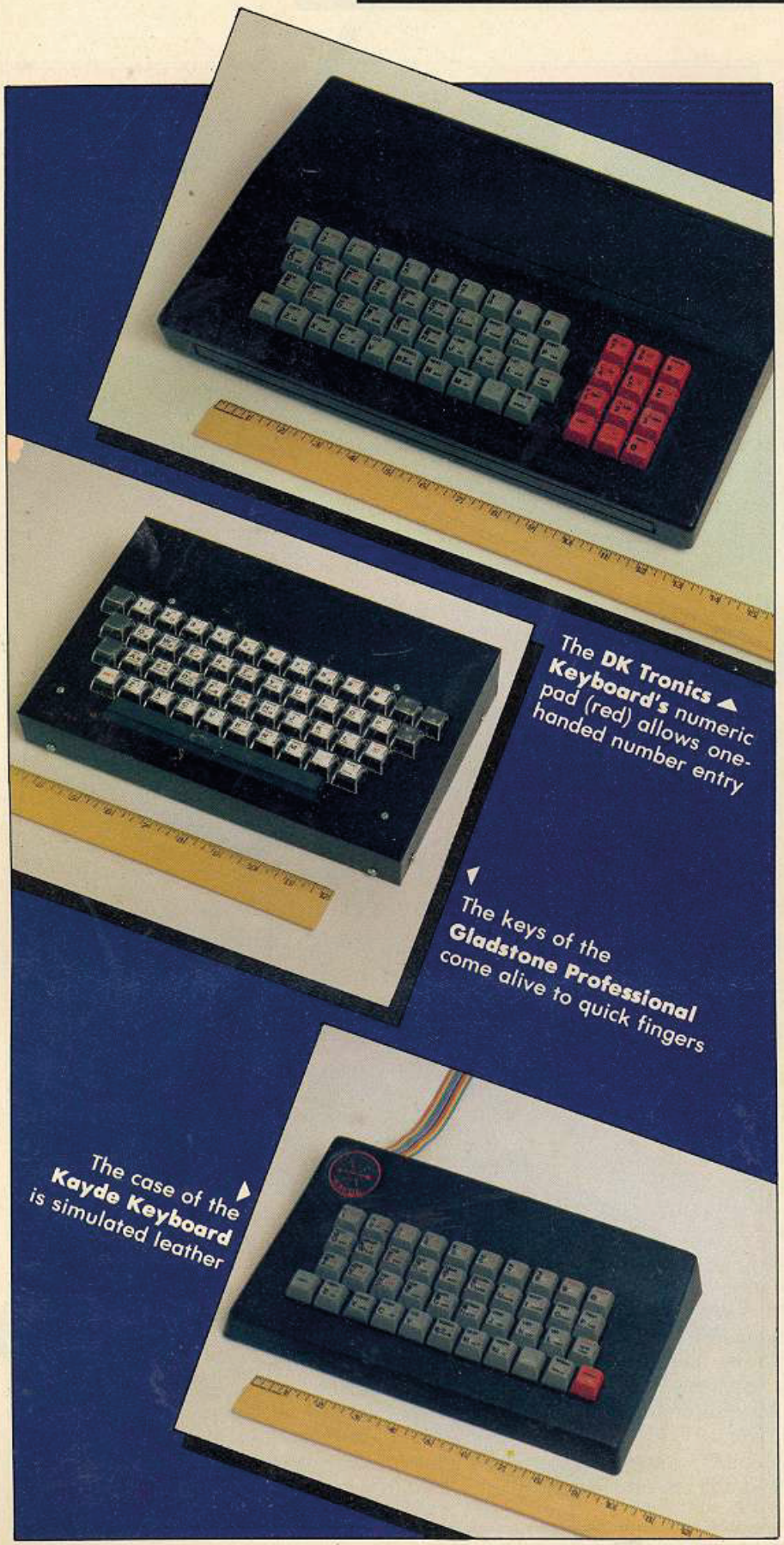
Kempston Micro Electronics of England takes an interesting approach to keyboard design. Unlike other keyboards that enhance or disguise your computer, the **Kempston Klik-Keyboard** is small enough to fit neatly on top of it. The Klik requires no case and installs in three steps: first, remove the T/S's keypad by peeling it off and unplugging it; second, feed the connecting cables through the slot in the case; third, fit the keyboard with the supplied adhesive pads and press it firmly onto the case. The keyboard

## The Kempston Klik sits on top of the existing keyboard

sits neatly in the recess left by the membrane keypad. Though its connecting wires end with little prongs which are more difficult to plug in than ribbon connectors, the Klik is fairly easy to install, and once installed is a permanent part of the computer. Its smallness is its main drawback however, as the keys must be painstakingly stroked one by one.

The legends on the keys, printed on gummed stickers, must be manually applied, which can be tedious: the keys are so small the procedure is also apt to be slow. When applying them you must take special care that they are properly aligned, for even one out of place may ruin the appearance of the whole unit. The Kempston Klik has 40 keys, and each emits an audible click when depressed: hence the name. There is no space bar. This keyboard duplicates that of the original, but because of its size also retains many of its problems.

Another keyboard with keys that click is the **E-Z Key 60** from E-Z Key. Perhaps the best-designed and most convenient to use of the six, the E-Z Key has 60 oval keys and resembles a modern push-button telephone as



The **DK Tronics Keyboard's** numeric pad (red) allows one-handed number entry

The keys of the **Gladstone Professional** come alive to quick fingers

The case of the **Kayde Keyboard** is simulated leather

much as it does a typewriter. The keys are well-spaced and require only three ounces of force to operate, making touch-type programming a breeze. It has two shift keys, a five-inch space bar, a separate numeric keypad and a larger ENTER key conveniently placed near the home keys in touch-type position. Another plus is its eight automatic shift keys which control edit, delete, single quote, double quote, colon, semi-colon, function and stop — a great boon to quick and easy programming. The legends, silkscreened in three colors on the case and molded on the

As its name suggests, the E-Z Key 60 is 'E-Z' to use

key tops, may appear at first glance to be merely a cosmetic attribute, but they comprise another innovative feature of this unit. Characters that require use of the shift are printed in red, corresponding with the red shift keys; those requiring the function key are yellow to correspond with the yellow function key.

To assemble the E-Z Key 60, plug in the ribbon connectors and attach the computer to the keyboard case, already pre-fitted with mounting screws. The instructions are precise and easy to follow, and once assembly is achieved you will have an attractive blue and gray unit that houses your computer. The cases are sold separately: you have the choice of two, one slightly larger than the other. As the name implies, this is indeed an "E-Z" keyboard to assemble and operate.

The **DK Tronics Keyboard**, like the E-Z Key, actually has two parts — a keyboard and a case. The full-sized typewriter style keyboard has 52 keys, 12 of which are for the numeric keypad: the 0 to 9 keys, a full stop, and a shift key. The

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# TSU Rates the Keyboards

| Keyboard | Assembly required? | Does keyboard sit apart from computer? | Numeric pad? | Space bar? | Overall Rating | Suggested Retail Price | Circle Reader Service No. |
|---|---|---|---|---|---|---|---|
| Memotech | No | Yes | No | No | ★★ | $100 | 43 |
| Kempston Klik | Yes | No | No | No | ★★ | $50[1] | 44 |
| E-Z Key 60 | Yes | No | Yes | Yes | ★★★★ | $85 | 45 |
| DK Tronics | Yes | No | Yes | No | ★★★ | $81[1] | 46 |
| Gladstone Professional | Yes | No | No | Yes | ★★★½ | $80 | 47 |
| Kayde | Yes | Yes | No | No | ★ | $75[1] | 48 |

[1]*Units sold by mail from U.K. Price does not include shipping charges.*

numeric keypads are useful to anyone entering a lot of numbers, since it requires only one hand.

Assembly requires no electronic skill and no soldering — simply remove your computer from its case and plug in the ribbon connector. The new case fits over both, leaving you with an attractive self-contained unit. You can connect other peripherals to the edge connector that extends from the rear. In all, the DK Tronics keyboard is responsive and fast, though its lack of a space bar is a slight inconvenience.

The **Gladstone Professional Keyboard** features a full-sized keyboard with 47 keys and a space bar. It has six extra keys which electronics buffs may hook up for greater convenience, but it performs just as well without them. The legends, clearly printed in black on white with shifted characters in red, will not wear off as each key is protected with clear lucite. The ENTER key is conveniently placed for easy acessibility, so you don't lose the flow when touch-typing.

Assembly is simple: plug in the flexible ribbon connectors and place the computer inside the handsome black metal case (which easily accommodates plug-in peripherals).

The keys of the Gladstone Professional come alive to quick fingers, and require only a light touch. Comfortable to use, well-suited to long programming sessions, it is as its name suggests, truly professional.

I found the **Kayde Keyboard** from Kayde Electronic Systems the least satisfying to use. It is slightly less expensive (see chart) and more difficult to assemble than the others. Where the others feature prong-tipped or flexible ribbon-type connectors, the Kayde has multi-colored wire connectors that are slightly too thick to slide through the slot in the computer case; some force is required to push them through, and once through they leave a small unsightly bulge in the case. The wires end in small plastic discs, one of which, too large for the socket, requires trimming. Two wires must be stripped and soldered. The Kayde has 40 steel-gray plastic keys, a repeat key, no space bar, and a black molded case that resembles simulated leather. The legends are printed on pre-cut gummed labels which must be peeled off and painstakingly applied. The sturdiness of this unit is questionable as each time a key is pressed the keyboard sags slightly. The Kayde keyboard sits apart from the computer but without the tastefulness of the aqua-blue Memotech or the Kempston with its tailored aspect.

How to make inputting easier without buying a keyboard? For about $10 you can buy a clear plastic overlay that attaches permanently to your computer: just peel off its backing paper and press it firmly in place. It offers none of the advantages of the keyboards but it is an inexpensive way of separating the keypads and providing a firmer reference for your fingers.

THERE are other keyboards available for the T/S1000,ZX81, but these represent a fair sampling. If you seek an attractive, well-designed keyboard that will house your computer and is suited to lengthy programming sessions, your best bet is the E-Z Key or Gladstone Professional; for their superior design and performance, they can't be beat. For those of us who shy away from assembling a keyboard of any kind, try the Memotech, which need only be plugged in. Remember, it is wise to carefully appraise your needs beforehand, and make your purchase accordingly.

**Only two of the keyboards have a separate space bar**

# SYNTAX

SERVING TIMEX-SINCLAIR PERSONAL COMPUTERS

A PUBLICATION OF **THE HARVARD GROUP**

ISSN 0273-2696

SYNTAX is a monthly newsletter exclusively for ZX80/81/TS1000 owners. We bring you news, reviews and applications for your computer, plus technical notes for circuit-builders. SYNTAX also provides a forum for thousands of users to share advice and problems about programs and vendors. We bring you timely updates about new hardware, software and books. And we cover *all* the Sinclair-technology computers, including the new TS1000.

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# Tips for Beginners

BUYING a Timex Sinclair machine can be the start of a lifetime obsession with home computing. It is easy, however, to become discouraged if everything does not go according to plan from the beginning.

For those with only a little knowledge of computers and their capabilities, the best way to approach the machine is to abandon any ideas for special uses. It is better to become familiar with the many facilities and then decide how you wish to use them.

Begin by unpacking your machine, overcoming your surprise at its size and weight and, following the manual to set up the system. If you cannot get the K on the screen, check that everything is plugged into its correct socket and reset the machine by pulling out the power plug for one second and plugging it in again. If still nothing appears, check the power supply unit by shaking it. If it rattles, return it. If it is okay, check your system with that of a friend.

Once the K appears you are ready to begin learning about your machine. It can prevent family arguments if you can afford a separate television set for your system. It also makes life easier if you find somewhere to leave your equipment set up permanently. You will find that a few power sockets are needed and a four-way block connector on a short length of extension cable will help to make it tidy.

The manual is written in great detail and is reasonably easy to follow. Some of the chapters may not seem immediately relevant but it is worthwhile reading them as you might miss something important.

At this stage, patience is needed in learning the ways in which the computer will accept information. It is tempting to try to enter programs before you are ready but that is likely to lead to errors. For example, words like AND, THEN and AT should not be typed in letter by letter.

## Warning: using a T/S1000 can be habit-forming

By the time you have reached chapter eleven in the T/S1000,ZX81 manual, you should have accumulated sufficient knowledge to be able to type in other people's programs, such as those in *Timex Sinclair User*.

It is important when using the T/S1000,ZX81 that it is not jolted. Some of the connections can easily work loose and everything which has been entered will be lost.

As a way of relaxing you can buy some of the growing range of commercially-produced software. This can be loaded directly from cassette but make sure that your machine is big enough to take the tapes you buy.

The tapes vary in quality, and it is advisable to read the reviews in *Timex Sinclair User* and use your judgment to find the best.

An alternative method to learn about the T/S1000,ZX81 is to plunge in at the deep end and see what the machine will do. Refer to the manual when you have difficulties. You can ignore the functions and calculations initially and experiment with PRINT statements to obtain the feel of the machine.

You may already have heard about the problem involved in SAVEing and LOADing your own cassettes.

Usually they occur when LOADing tapes recorded by other people. One simple method to overcome this is to wind the tape to the middle of the program and type LOAD"" followed by ENTER; then increase the volume of the recorder slowly with the tape running until the television screen shows four or five thick black bands. If you then rewind the tape, the program should LOAD normally.

Finally, a health warning. Apart from any practical uses, computing with your Timex Sinclair machine can be a very entertaining hobby and is almost certainly habit-forming. You may easily find yourself crouched over your machine, red-eyed, in the early hours of the morning thinking that in another five minutes you will solve the problem. Try to break that habit by getting into the fresh air and meeting other Sinclair users.

By obtaining a Timex Sinclair computer you find that you have joined a not very exclusive club with many thousands of members, many of whom would be only too happy to advise you if you have difficulties.

Make sure of your regular copies of *Timex Sinclair User* and you can be guaranteed many happy hours.

# GLOSSARY

**Basic** — Beginners' All-purpose Symbolic Instruction Code. A programming language resembling English which is used by beginners because most popular microcomputers have it as standard.

**Bug** — an error in a program.

**EPROM** — Erasable Programmable Read-Only Memory. Semi-permanent storage. Information is not erased if the power is turned off in the computer. Programs can be erased by subjecting the memory chips to ultra-violet light. The memory can then be reprogrammed using an electrical device called an EPROM blower.

**Interface** — RS232 and Centronics. A device which enables other computers or add-ons, such as printers, to be connected to the computer. It converts non-standard signals from add-ons to the standard signals of the computer in use.

**Kilobyte (K)** — A measurement of memory size. Most machines use 16K as a minimum but 48K is generally agreed to be necessary for serious work.

**Machine code** — An electronic pulse code used by the computer to perform functions and communicate with memory and other devices.

**Mnemonics** — Abbreviated instructions — e. g. LD for Load — used in machine language programming.

**Motherboard** — An external printed circuit board which is used like a multi-way plug planner. It enables other printed circuit boards, such as graphics boards and color boards, to be slotted in.

**Port** — A link to the outside world which can be used by programs and the computer.

**PCB** — Printed Circuit Board. A board which has on it the electronic circuits of the computer.

**RAM** — Random Access Memory. Information and programs can be stored in this type of memory as electronic pulses which conform to a set of numbers — machine language — in which programs are represented in the computer. When the power is turned off the information will be lost.

**ROM** — Read Only Memory. Information stored in this type of memory is not lost when the power is switched off.

**Software** — Programs which control the operation of the computer.

**Syntax error** — a bug caused by incorrect use of a programming language.


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Has your T/S1000 ever crashed? If so, chances are it was due to overheating — probably the most common cause. Warren Smith discusses the problem and prescribes how you can help your computer keep its cool

# Hot under the Microchip

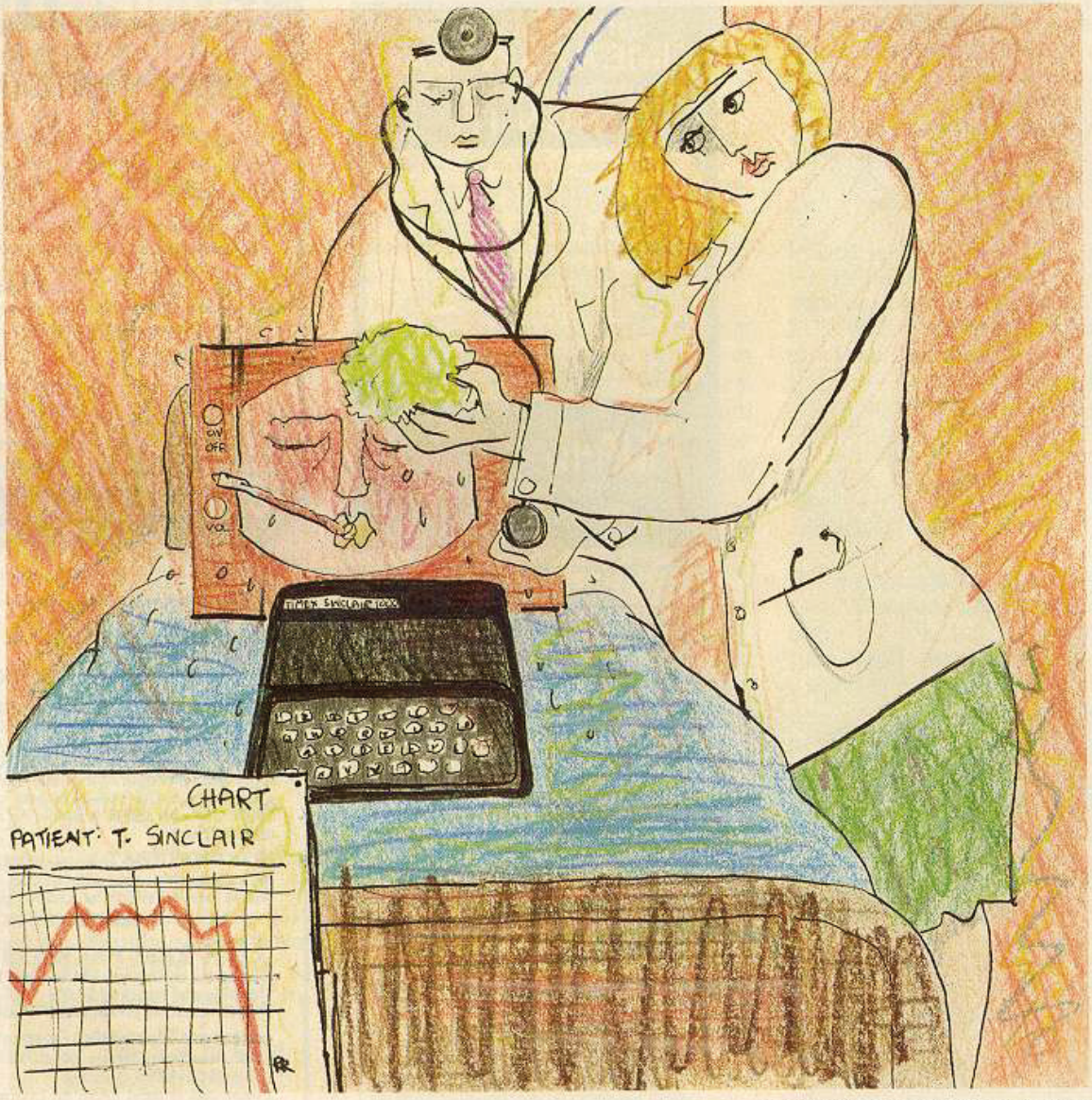


ILLUSTRATION • Rochelle Rubinstein-Kaplan

# Hints & tips

IT COMES to you in a flash of inspiration — a brilliant solution to the programming bug that has foiled you for days. ENTERing line after line before the idea leaves your head, you work excitedly and quickly — too quickly to break to PRINT your subroutine or LOAD it onto tape. Too bad.

In your feverish pitch you have forgotten that the T/S sometimes gets feverish as well — overheated. And when that happens it has a tendency to crash, sending the contents of its short-term memory on a one-way trip to Never-Never land. Just as you near the end, the screen goes blank and everything is wiped out.

Heat build-up is a problem with most computers. Even Apple II owners sometimes add fans to their expensive systems to cool them down. Most Timex crashes are caused by overheating. The problem is intensified by an undersized heat sink attached to the voltage regulator. The interior of the Timex is a bright shiny metallic case that also increases heat build-up.

As your manual explains, Timex operates quite well as long as the direct current (DC) fed into the system ranges between seven and 11 volts. The transformation occurs in the voltage transformer that plugs into the wall socket. The transformer brings the voltage down to around nine volts, then feeds it to the computer via the lead line.

The problem occurs because Timex chips need only five volts to operate. This means the voltage regulator must retain some power, which is excess energy (or heat). The excess heat must go some place, so the heat sink was designed to absorb it.

Unfortunately, an undersized heat sink was designed into the system. The more work the voltage regulator performs, the more heat builds up inside the computer. Because there are no vents in the solid plastic case, the heat just bounces around.

Sooner or later the heat sink reaches a critical point. The device simply cannot soak up any more heat and components get as hot as marathon runners in the Sahara. Then one yells "Mayday!" and the system crashes. You are out of the computing business until the Timex cools down.

**Never use your computer in direct sunlight**

At a user group meeting in Chicago, Joseph D'Antelloni told me that overheating crashes were a problem with his machine. "I learned to LOAD every four or five lines of completed code. It was a distraction but a good habit to keep up."

One afternoon while working on a complex subroutine for an adventure game, D'Antelloni became engrossed in writing the code and forgot to LOAD his program onto tape. The system overheated and failed and he lost about 20 lines of intricate code. That was when he decided to do something about the problem.

He discovered a book entitled *The Sinclair ZX81 and Timex 1000 — Programming for Real Applications* by Randle Hurley (Dilithium Press, $15.95). In the chapter called "Hardware Modification," the author writes that nine volts are too heavy a load for the voltage regulator, and states his belief that a good compromise is an eight volt feed-in.

"... If the power pack was

## Crash Insurance

That little beastie, the T/S1000,ZX81, is a good machine — most of the time. Benchmark tests have pitted it against hefty competitors like the IBM PC, Apple II and other machines. In most instances, our little David devastates the Goliaths by performing much faster.

Yes, the Timex is excellent — until the system crashes.

Crashing is one of the major frustrations of T/S users. Programs that may have taken hours to type in are vanquished in the blink of an eye. As we explain in the accompanying article, many Timex crashes are caused by overheating of the components. But other factors cause the T/S to crash as well.

One of the most annoying may be attributed to bumping the RAM module attached to the rear of the computer and, there is now a product called **Crash Guard** marketed by Expense Cutter Products, to prevent the computer from crashing when this happens. Crash Guard is a heavy-gauge acrylic device that fits over the RAM module. To learn more about this product, circle 55 on reader service card.

Electric current is not constant but surges up and down depending on demand, and crashing may be also caused by interruptions in the electrical voltage. To correct this source of computer failure you may need a **Power Line Filter** such as the one made by Hurricane Electronics. Their five-amp filter kit is $23.95; fully assembled, $29.95. The unit prevents power line interference from reaching your computer. For more information, circle 56 on the reader service card.

A power supply buffer called the **Cobra** is offered by Cobra Technology of London. Their product sells for $22 (plus $7 shipping). The Cobra, which prevents spikes (jumps upward) in electrical current from reaching your T/S1000, is also a battery pack that keeps your computer alive for 30 minutes during a power failure — ample time to LOAD the computer memory onto tape. To learn more about the Cobra, circle 57 on the reader service card at the back of this magazine.

Watch these pages for a comprehensive treatment of the crashing problem, coming soon.

**— W.S.**

designed to deliver the minimum of seven volts then all would be well until the first power crisis, when the mains (line) voltage is dropped by twenty or so volts," Hurley writes. "This would drop the output of the power pack below the seven volts required, and switch off the machine. A good compromise is to design a power pack to run at eight volts. This has a significant cooling effect."

D'Antelloni and a friend, an electrical whiz, followed the schematics for the power pack in the back of the book. They bought the necessary parts wholesale for a few dollars and assembled the unit in an evening over a six-pack of beer. Now D'Antelloni can use his machine without fearing heat build-up and crashes.

When the Sinclair first arrived on the North American scene, Bob Benson of Milwaukee purchased one. He became frustrated with frequent failures of the system: it would run for about 20 minutes, then go into a kamikazi dive. No one was then admitting that the system could overheat and fail, but after talking to several computer professionals, Benson was convinced that overheating was the culprit. So he took the computer to a local machine shop where its plastic case was removed, revealing its interior metal lining.

The machinist was not impressed. "That's all there is to this thing?" he asked, pointing to the tiny chips. He suggested painting the heat sink and the metal casing black.

> The metal lining inside your T/S retains a lot of heat

"I want to solve the problem permanently," said Benson.

"Then you ought to drill a couple of holes to let the heat escape."

In ten minutes several holes had been drilled through the plastic case and its metal lining. These openings allowed the heat to escape, avoiding hot temperatures inside the computer. Naturally, the holes were drilled at points where the components would not be disturbed.

The machinist's fee was $18. Benson spent another couple of dollars for a fine mesh screening which was pasted over the holes with epoxy glue. The mesh has done a fine job of trapping dust particles that might otherwise enter the machine and create problems.

Other users overcome their heating problems by replacing the heat sink, and report the enhanced sink prevents system failure. One of these improved sinks is sold by The Basco Company of Milford, Connecticut; for more information on their product, circle 58 on the reader service card at the back of this magazine. An indirect method of handling the overheating problem is by selecting a keyboard that houses the computer and features a few slots in the bottom to allow heat to escape.

Overheating can also be caused by the computer's surroundings. Keeping your computer in a hot room will add to the problem. Computing near a window with direct sunlight hitting the plastic case is not recommended.

Insiders claim that Timex may be acknowledging the problem of overheating. A model 1500 will be marketed by July, possibly introduced at the Consumer Electronics Show in Chicago or at COMDAX in Atlanta. Timex has been very secretive about the project. However, my sources claim that Timex has gone back to the drawing board for the T/S1500 and added a larger heat sink.

Though Timex is probably correcting the overheating problem, those of us who own a T/S1000 or ZX81 must be careful. If you can't make the physical changes described, at least you can watch where and how you use the machine. If you continue to have problems with crashing and you don't think it's caused by overheating, let us know and we'll try to provide a solution for you in these pages. In the meantime, happy programming!


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# Bulletins

## Got some information you'd like to share regarding a new product or service or idea? Organizing an event you'd like to see listed? Let us know!

Write to Bulletin Board, Timex Sinclair User, 49 La Salle Avenue, Buffalo, N.Y. 14214

**Hawg Wild Software** of Little Rock, Arkansas, gives a ten per cent discount on software to preregistered members of clubs, user groups and camps. Good idea, no? Their product list includes a Football Forecaster: $19.95 for either the NFL or College football version and $29.95 for the two. For more information circle 60 on the reader service card.

"Congratulations on the occasion of your first American issue!" writes **Richard D. Boltuck,** president of an Indiana firm called **Silicon Valley North.** "Like *Timex Sinclair User*, our partnership is new. We are dedicated to serving teachers and professors who own the Sinclair family of computers." SVN's flagship product is Gradebook, a "sophisticated, friendly and flexible grade management program." To learn more, circle 61 on the reader service card and drop it in the mail . . .

**Michael Day** of **Daydesign,** Troy, Michigan, tells us of a product called My Type, which teaches touch-typing on your add-on keyboard. "Features include key location, review, and token command drills. Mistakes and w.p.m. are given at the end of each lesson." Daydesign also markets a set of dry-transfer legends to stick on the keys of larger keyboards. For more information, circle 62 on the reader service card at the front and back of this magazine . . .

**T-S Systems & Reference** of New York City offers an information packet on using PASCAL on the T/S1000,ZX81. For more information, 63 is the number to circle on the reader service card.

"In any other time or galaxy, the dustball of a world called Tai would have been quite unimportant. Times change. Now it is the last remaining outpost of the Republic. You must hold off the advancing Imperial forces until the Republican battle fleet arrives, or an entire civilization will be betrayed." You've been reading **Intercomputer's** description of its Tai arcade program. Sounds an awful lot like Star Wars and probably lots of fun. Circle 64 for more information . . .

Did you know that **Mindware Inc.** of Natick, Massachusetts, markets 20 software programs that feature a proprietary loading aid called Quickload that makes LOADing four times quicker? Now you do. "Perhaps more significant," Mindware president **Michael Levy** tells us, "is the fact that Quickload verifies whether or not the computer is loading properly — which solves a significant problem inherent in the T/S1000 design." With Quickload, the screen goes blank when information is lost, allowing the user to rewind the program only a short way and resume input. To learn more, circle 65 on the reader service card and see our August issue . . .

**Micro Developments** of Berkley, California, sends customers informative technical notes regarding the T/S1000,ZX81. "Customer Update #2" addresses cleaning up the video display. "The problem is that the television and the Sinclair do not have a common ground . . . The Sinclair ground is connected to the shield of the television cable (the outside conductor on the jack), which carries through to the case of the television selector box (on the back). For solid state televisions (essentially all modern ones), almost any external metal on the back of the case will serve as the ground connection. We strongly recommend that those with old tube-type sets (because of their high voltage) refrain from trying this simple solution. If they have a problem with video, we suggest that they convert the Sinclair to a UHF modulator." Circle 66 on the reader service card to learn more about Micro Developments . . .

**DK 'Tronics Ltd.** of Saffron Walden, England, informs us that they've received their largest single order to date: one of Britain's largest record distributors wants £150,000 ($240,000) worth of software. How does that stand up against some of our big transactions? . . .

From **MicroSync Services,** Keene, New Hampshire, you may now obtain a maintenance agreement for your T/S1000,ZX81 and add-ons. It's $12 for 12 months coverage for a new machine, $10 for a new 16K RAM. For their full schedule of rates, circle 67 on the reader service card . . .

"The Sinclair ZX81 broadcasts a faint radio frequency signal all over the AM and FM band," writes **G. Wayne Finger,** whose Jacksonville company, **Florida Creations,** markets a software package designed to control the radio frequency interference generated by the computer, allowing you to broadcast music and spaceship noises to a nearby radio. Sound intriguing? Circle 68 on the reader service card for more information . . .

**L. Harmon** of Metairie, Louisiana, announces three new products for the T/S: Mail Master, Data Master and Chart Master. We haven't tested them, but the descriptions sound good and at $6.95 each, the price is right too. For more information circle 69 on the reader service card . . .

We omitted several credits from the May issue, and we apologize for any

### Upcoming Events

**July 11-13:** Meeting World, New York, New York
**25-29:** Siggraph '83, Detroit, Michigan
**29-31:** Los Angeles / Produx 2000, Los Angeles, California
**August 24-26:** New York / Produx 2000, New York, New York

embarrassment or inconvenience this may have caused. **Filesixty,** a company producing keyboards for the T/S1000,ZX81 (see page 2 in this issue) was left out of our ad index. In our *Hardware* pages we forgot to tell you that **Data-Assette** distributed the ZX-99 RS232C Tape Control System. And the photos accompanying the User Group article were taken by **Patrice Flech** of Boston, whose work you'll be seeing more of in August. Sorry, Pat! . . .

We'd like to thank all of you who brought to our attention the small error in the listing of the **London Bridge** program in our May issue. Line 220 should read: 220 LET N1=N+5* (INT I-1) +3* (I-INT I)-1

We hope you weren't too inconvenienced by the mistake!

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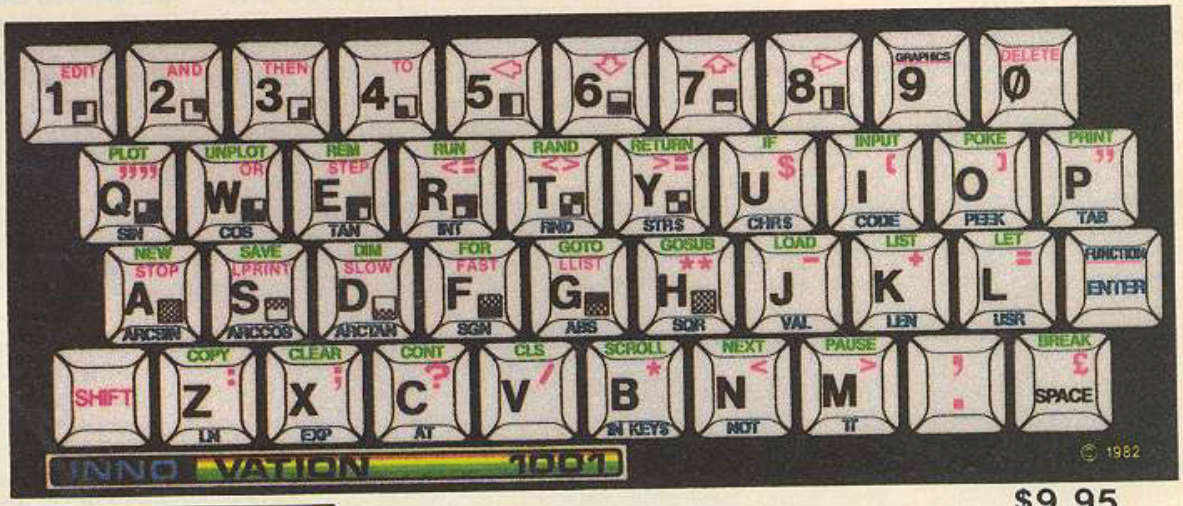


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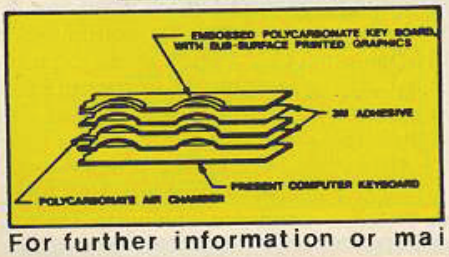


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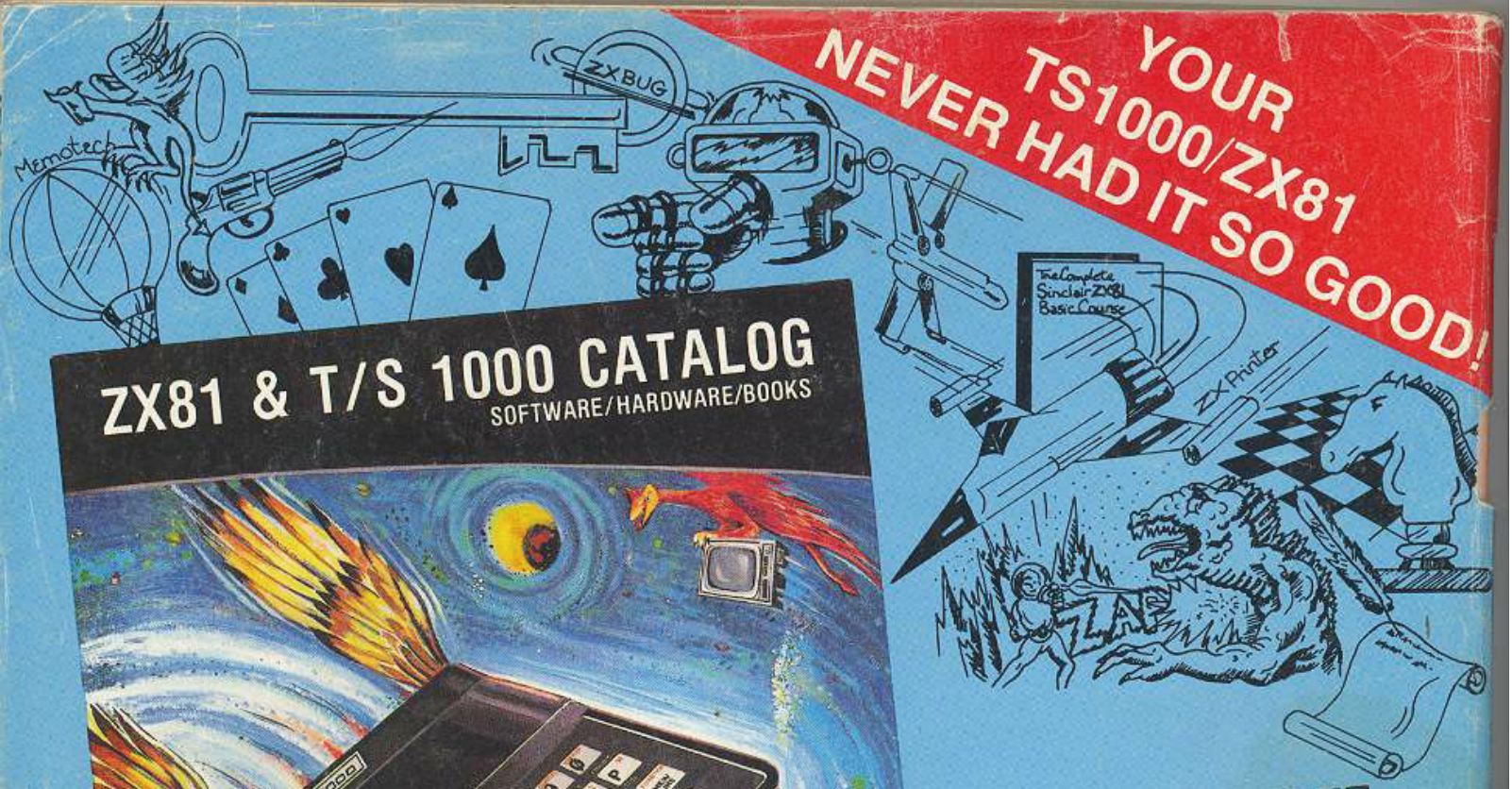


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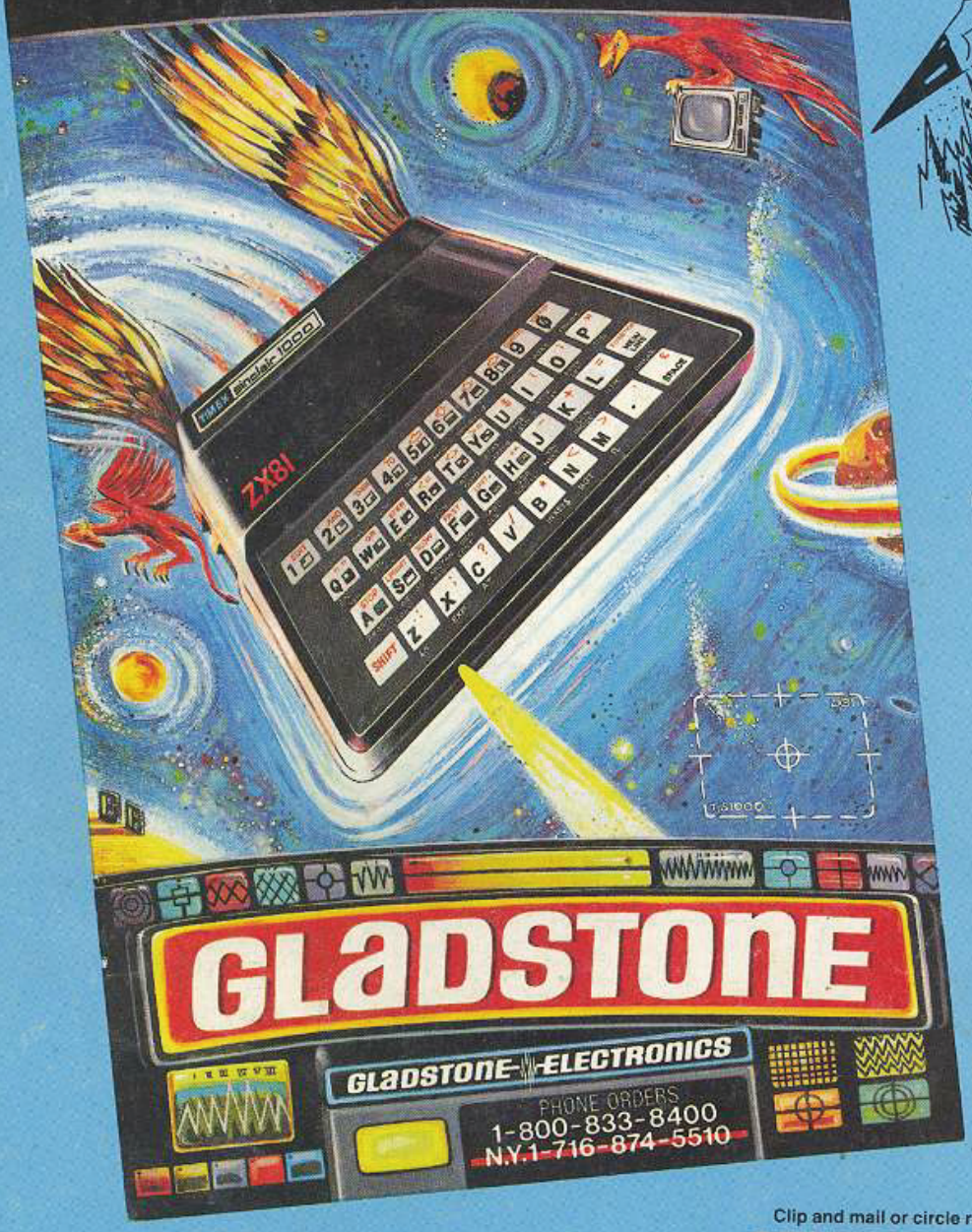


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